Asia's New Standard for Success:

Energy Efficiency Standards and Labeling Programs in 12 Asian Countries

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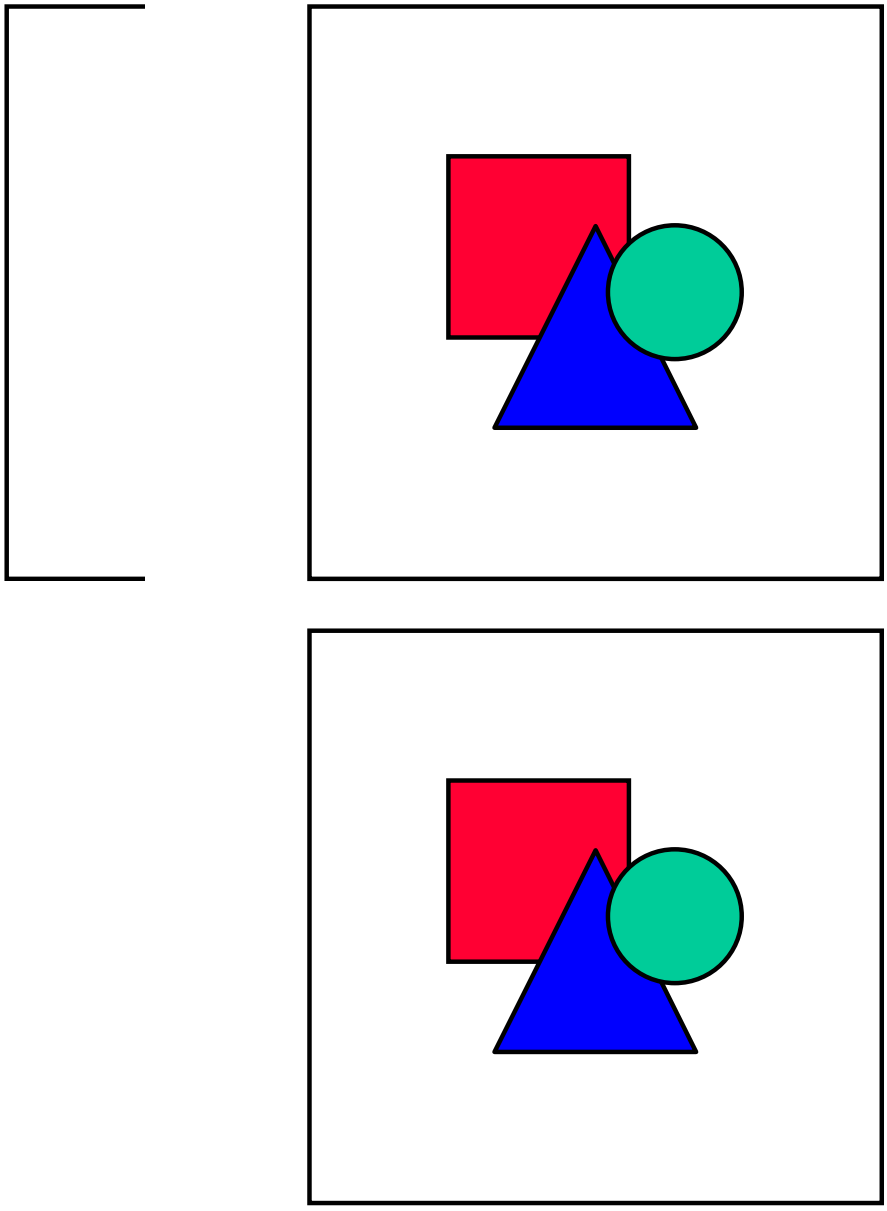

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[1] The information contained in this document does not necessarily reflect the views of supporting organizations. The information has been prepared by the International Institute for Energy Conservation and represents our perspective on the programs in Asia and the needs of the region.

About IIEC

Founded in 1984, the International Institute for Energy Conservation (IIEC) is a non-profit, non-governmental organization which seeks to accelerate the global adoption of energy efficiency policies, technologies, and practices, with the intention of promoting sustainable development. IIEC focuses on industrializing countries and countries with economies in transition.

To this end, IIEC has established four offices around the world: the North America Office in Washington, DC; the Asia Office in Bangkok, Thailand; the Africa Office in Johannesburg, South Africa; and the Europe Office in London, United Kingdom. IIEC staff work closely with developing-country governments, utilities, the private sector, and other non-governmental organizations. IIEC receives support from foundations, the private sector and governments around the world, including the European Commission, the US Environmental Protection Agency, the US Agency for International Development, and the Japanese and Thai governments.

IIEC is working with other Asian organizations to improve the efficiency of appliances and electric equipment in Asia through its global standards program. The program aims to build capacity for developing and implementing energy efficiency standards regimes in Asia.

Kristina Egan and Dr. Peter du Pont work in IIEC's global standards program. Ms. Egan has managed the program in Bangkok for two years and Dr. du Pont, Managing Director of the Asia office, recently completed his doctoral dissertation on energy labeling in the US and in Thailand.

Executive Summary

Asia's use of energy will continue to dramatically increase unless changes in energy-consuming infrastructure are made. One of the most effective and proven tools for increasing energy efficiency is establishing energy efficiency standards and labels. Several countries in Asia have successfully established standards and labeling programs, employing creative and culturally-adapted methods that serve as models for the world.

The time is opportune for accelerated development of standards regimes in Asia. The recent economic downturn in Asia provides an opportunity for building energy-efficient infrastructure, such as more efficient household appliances and industrial motors. Demand for these energy-consuming devices will temporarily decline as many Southeast Asian economies contract. This provides a window of time for governments to draft legislation and manufacturers to adjust production lines. In the long-term, these investments in energy efficiency will aid Asian nations in their struggles to 1) retain foreign reserves through reducing demand for petroleum and capital for power plant construction; 2) recapture former economic development rates by reducing national energy intensity; and 3) protect national and international ecosystems.

This report scans standards and labeling activities in twelve Asian countries. We provide technical and policy information on the programs in the hopes that successes can be replicated across nations. We also assess the need for enhanced technical and financial resources to strengthen current activities or initiate new ones in each developing country. Recommendations are made in order of priority at the end of the document.

Of the developed Asian nations, Japan, the Republic of Korea, and Taipei China (Taiwan) have achieved documented success with standards and labeling programs. Of the developing Asian nations, Thailand and the Philippines deserve international recognition for their creative approaches to building comprehensive national standards regimes. Below, we present a brief summary of the status of standards and labeling programs in Asia.

- **The People's Republic of China**[2] has established standards for refrigerators, clothes washers, room air-conditioners, as well as some less energy-consuming products. There is no energy labeling.
- **Hong Kong** recently began a voluntary labeling scheme which covers all refrigeration appliances, room coolers, and washing machines. The government is monitoring the program to determine whether to make labels mandatory and/or set standards.
- **India** has ineffective voluntary standards for refrigerators and air-conditioners. The government and manufacturers are presently discussing the potential for voluntary labeling schemes.
- **Indonesia** has neither standards nor labeling programs. Because of insufficient testing infrastructure, the government's priority is to build a testing laboratory for refrigerators and air-conditioners. Plans are underway, though the current Asian economic crisis has suspended support from the Asian Development Bank for this activity.
- **Japan** has extensive experience with efficiency standards, having first issued them for refrigerators and air-conditioners in its Energy Conservation Law of

[2] From here forward, we refer to the People's Republic of China as China.

1979. In 1994, standards for fluorescent lamps, televisions, heat pumps and copiers were added, while standards for refrigerators were eliminated.

- **Republic of Korea's**[3] standards and labeling program covers air-conditioners, refrigerators, passenger cars, lighting equipment and some commercial and industrial equipment.
- **Malaysia's** Ministry of Energy, Telecommunications and Posts issued efficiency standards for motors in 1989. There is no labeling, though Tenaga Nasional had a brief lamp- and fan-labeling program circa 1994.
- **The Philippines** set minimum efficiency standards and developed a mandatory labeling scheme for air conditioners in 1993. This year, this successful program was expanded to refrigerators, and a schematic was devised to incorporate at least 4 more products before 2000.
- **Singapore** has an energy-efficiency standard for room air-conditioners, however, none of the accredited laboratories conducts energy-efficiency testing and there is no mechanism in place for verifying manufacturer compliance. There is no energy labeling, although green labeling for energy-consuming devices has been initiated.
- **Taipei China's** (Taiwan's) efficiency standards cover twelve products.
- **Thailand's** DSM Office established a voluntary labeling program for refrigerators in 1995 and for air conditioners in 1996. An endorsement labeling program for high-efficiency industrial motors recently began. The government plans to set standards for air-conditioners, refrigerators, motors, and ballasts before the turn of the century.
- **Viet Nam** has neither standards nor labeling programs, though plans are underway to build a national standards regime.

Asia's countries have developed dissimilar programs, many of which have not yet been properly evaluated. Despite lack of data, standards and labeling are generally viewed by many policy-makers in Asia as effective tools for boosting energy efficiency due to long histories of fruitful government-industry collaboration and the cost-effectiveness compared to other policy tools for increasing energy efficiency. Standards and labeling activity has been surging in recent years, but governments and utilities are now facing the need for technical assistance on several fronts. IIEC's recommendations prioritize the next, most urgent actions needed for building national standards regimes in each of the developing Asian countries.

[3] From here forward, we refer to the Republic of Korea as Korea.

Recommendations for Regional Action

- Create an on-line Information Clearinghouse to facilitate exchange of technical information and documents between professionals from different countries.
- Offer Technical Trainings to develop skills in setting up testing infrastructure and in selecting testing procedures, methodologies for deriving standards, and label and labeling program design.
- "South-South" Information forums and colloquiums in which technical and policy professionals share successes and failures, with the goal of developing national standards regimes that are appropriate and effective.

Recommendations for National Action

■ China	Training on devising standards
	Collecting and analyzing baseline market data
■ India	Training on label and labeling program design
	Training on devising standards
	Run a consumer advertising campaign when program in place
■ Indonesia	Establish testing infrastructure
	Training in label and labeling program design
	Run a consumer advertising campaign when program in place
■ Malaysia	Establish testing infrastructure
	Training in setting up standards regime
	Run a consumer advertising campaign when program in place
■ Philippines	Upgrade testing facilities and place testing facilities in sustainable self-financing business structure
	Conduct program evaluation
	Launch aggressive advertising campaign
	Training in devising standards
■ Thailand	Establish motors testing facility
	Training in devising standards
■ Viet Nam	Establish testing infrastructure
	Training in setting up standards regime

We conclude by inviting technical and policy professionals to contact IIEC. IIEC is enthusiastic to learn of standards-related efforts around the world, and we look forward to providing assistance in promoting energy efficiency through standards and labeling.

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Acronyms

ADB	Asian Development Bank
AGREE	Asian GRoup for Energy Efficiency
AHAM	Association of Home Appliance Manufacturers (Philippines and US associations use the same acronym)
ANSI	American National Standards Institute
APEC	Asia Pacific Economic Cooperation forum
APLAC	Asia-Pacific Laboratory Accreditation Program
ARI	Air-conditioning and Refrigeration Institute (US)
ASEAN	Association of Southeast Asian Nations
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
AV	Adjusted Volume
BAPEDAL	Badan Pengendalian Dampak Lingkungan (Environment Impact Management Agency of Indonesia)
BIS	Bureau of Indian Standards
BPPT	BPP Technology-UPT/LSDE Energy Resource Laboratory (Indonesia)
BPS	Bureau of Product Standards (Philippines)
CEPALCO	Cagayan de Oro Power and Light Company (Philippines)
CEN	European Committee for Standardization
CENELEC	European Electro-technical Committee for Standardization
CFC	Chlorofluorocarbon
CFL	Compact Fluorescent Lamp
COP	Coefficient of Performance
CSA	Canadian Standards Association
DEDP	Department of Energy Development and Promotion (Thailand)
DGEED	Directorate General of Energy and Electricity Development (Indonesia)
DOE	Department of Energy (Philippines and US agencies use the same acronym)
DSM	Demand-side Management
DSMO	Demand-side Management Office (Thailand)
DSN	Dewan Standardisasi Nasional (Standardization Council of Indonesia)
EER	Energy Efficiency Ratio
EGAT	Electricity Generating Authority of Thailand
EMC	Energy Management Centre (India)
EMSD	Electrical and Mechanical Services Department (Hong Kong)
FATL	Fuels and Appliance Testing Laboratory (Philippines)
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
HCFC	Hydrochlorofluorocarbon
HEM	High Efficiency Motor
IEC	International Electrotechnical Commission
IIEC	International Institute for Energy Conservation
IPP	Independent Power Producer
IRP	Integrated Resource Planning
ISO	International Organization for Standardization
JIS	Japan Institute of Standards
KEMCO	Korean Energy Management Corporation
KONEBA	Konservasi Energi Abadi (Indonesia)
LBNL	Lawrence Berkeley National Laboratory
MEA	Municipal Electricity Authority (Thailand)
MERALCO	Manila Electric Company
METP	Ministry of Energy, Telecommunications and Posts (Malaysia)

MITI	Ministry of International Trade and Industry (Japan)
MoSTE	Ministry of Science, Technology, and the Environment (Korean, Thailand, and Viet Nam agencies use the same acronym)
MRA	Mutual Recognition Agreement
MW	Megawatt
NAPOCOR	National Power Corporation (Philippines)
NEDO	New Energy and Industrial Technology Development Organization (Japan)
NEMA	National Electrical Manufacturers Association (US)
NEPO	National Energy Policy Office (Thailand)
OCP	Office of Consumer Protection (Thailand)
OTTV	Overall Thermal Transference Value
PEA	Provincial Electricity Authority (Thailand)
PLN	Perusaahan Listrik Negara (Indonesia)
PSB	Productivity and Standards Board (Singapore)
SBTS	Chinese State Bureau of Technology Supervision (China)
SEER	Seasonal Energy Efficiency Ratio
SNI	Indonesian National Standard
TISI	Thailand Industrial Standards Institute
TNB	Tenaga Nasional Berhad (Malaysia)
USAID	United States Agency for International Development
UN-ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
WTO	World Trade Organization
YLKI	Yayasan Lembaga Konsumen Indonesia (Consumer Organization)

Terminology

- We use "testing procedure" to mean a testing methodology through which energy efficiency or energy consumption is measured. We use the term "testing procedure" to refer to a testing method, testing protocol, and testing standard.
- We use "energy standard" to mean an energy performance requirement that can be confirmed through a designated testing procedure or a prescriptive requirement, such as the presence or absence of some feature.[4] We use "energy standard" to encompass an energy performance standard, minimum energy performances standard, energy efficiency standard, and maximum energy performance standard.
- We use "energy label" to mean a label affixed to a product indicating energy consumption or energy efficiency. Unless otherwise specified, we do not use the term to refer to certification marking, which indicate the product has met an energy standard.
- We use "testing facility" to mean a testing laboratory and testing infrastructure

[4] Turiel, p 6.

Introduction

In Asia, inefficient appliances and equipment are increasing the region's demand for electricity, increasing the demand for foreign exchange to finance power plant construction, and causing environmental degradation. Demand for energy-consuming products reached annual sales growth rates of 20 percent in some countries before the recent economic downturn. Although consumption will fall as Asian economies contract, demand will likely rebound in the future. Anecdotal evidence suggests that appliances will remain some of the most coveted consumer items. For instance, in Viet Nam, 34 percent of newlyweds rate appliance ownership as the most important key to marital happiness.[5]

Figure 1. Wrecked ecosystem

Increasing appliance and equipment efficiency can help relieve deterioration of natural ecosystem, depletion of natural resources, and foreign reserve deficiencies.

Energy-efficient products have been quite slow to penetrate Asian markets due to barriers such as low electricity tariffs, high first-purchase cost of products, and lack of awareness about the monetary benefits of investing in efficient equipment. Because of these barriers, there is a need for market intervention. Standards and labeling programs are effective tools for promoting the production and consumption of energy-efficient equipment.

> ***There is a window of opportunity to leapfrog--perhaps technologically, and certainly in the sequence and timing of policy implementation--over the mistakes of more developed nations by "getting it right the first time."***

Asian countries have the opportunity to learn from the successes and mistakes of other "Southern" countries as well as industrialized countries in regards to fossil fuel dependency, artificially low energy prices, and a retroactive search for energy-efficiency programs and strategies. From these lessons, Asia can devise strategies for long-term energy reliability and

[5] *The Foreign Post,* p 10.

efficiency.[6] Asia has a window of opportunity to do it right the first time, marrying economic growth with energy efficiency.

In some countries, around the world and in Asia, standards and labeling programs have produced documented energy savings. However, in many developing economies, hurdles block the establishment or strengthening of national standards regimes. These obstacles include:

- inadequate technical infrastructure to produce replicable energy efficiency test results
- lack of skilled personnel to conduct energy efficiency testing
- lack of technical information on testing procedures selection, methodologies for setting minimum energy performance standards, and label and labeling program design
- low public awareness of the benefits of energy efficiency
- lack of baseline data on the efficiency of products on the market
- lack of personnel capable of conducting statistical and engineering-economic analyses
- lack of impact and program evaluations
- little knowledge of the successes and failures of other developing countries

This paper attempts to address the last obstacle by profiling national experiences with standards and labeling. We recognize the dynamism of energy policy formulation in Asia, and aim only to provide a snapshot of current progress in the region. We provide information about where to obtain technical information in the appendix.

IIEC's objectives in this report are to:

1• Provide Asian professionals with the technical information necessary to initiate testing, labeling, and standards activities. We scan existing efforts in the Asia region and highlight creative approaches to crafting programs appropriate to the Asian context.

2• Provide contact and resource information on organizations offering technical help

3• Link policymakers engaged in similar efforts in the region

4• Recommend where and how to channel financial resources to further develop standards regimes

[6] Silver and du Pont.

Scope of Report

This document discusses two types of market transformation[7] strategies—energy performance standards and energy labeling.

This report focuses on three product categories—air-conditioners, refrigerators, and industrial motors. These products were chosen because of their large and growing impact on energy demand. Air-conditioners and refrigerator sales are rapidly growing in Asia, and thus significantly contributing to peak electricity demand. Electric motors account for the majority of industrial electricity use in most countries. Some other products, such as lighting equipment, TVs, and irons, are also discussed when relevant. We do not discuss building codes and standards, although these are also powerful tools for reducing energy consumption and successful programs have been developed in Asia.[8]

This report covers twelve countries in Asia. These are: China, Taipei China (Taiwan), Hong Kong, India, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam. Several countries were not included because they do not yet have developed energy infrastructure, and have insignificant sales growth in appliances and electric motors. Although successful standards and labeling programs have been launched in several Western countries, we make no attempt to document these, as they have been well-documented already,[9] and because they cannot be blindly duplicated in Asian contexts with unique manufacturing sector structure, energy policies, and culture. Rather, we attempt to highlight creative Asian approaches to building standards regimes.

In order to develop the information in this report, IIEC conducted field research, collected papers from conferences, interviewed policy-makers and technicians, and drew from our market research. However, due to the dynamic situation in Asia, some information in this report will already be out-of-date by the time it is printed. We hope that the contact information included will allow readers to ascertain information on the latest developments.

[7] Market transformation refers to a set of programs or policies that are designed to upgrade the average energy efficiency of products available on the market. Market transformation strategies include regulatory and voluntary approaches, as well as technology transfer.

[8] For more information on building codes and standards, please consult the following organizations: National Association of Home Builders; Building Codes Assistance Project; National Conference of States on Building Codes and Standards, Inc.; Council of American Building Officials.

[9] **For Europe**, see: ADEME, Danish Energy Agency, March 1993; ADEME, 1994; Waide and Lebot. **For Australia, see:** Wilkenfeld; State Electricity Commission of Victoria; Harrington; Harrington and Wilkenfeld. **For United States,** see: Geller.

Electricity Demand in Asia

World energy demand is rising by approximately 2 percent annually but the annual rate in Asia for the past seventeen years has been 3.5 percent. The demand growth rate is even higher for China, Korea, Malaysia, Singapore, and Thailand, averaging over five percent annually between 1980 and 1991.[10]

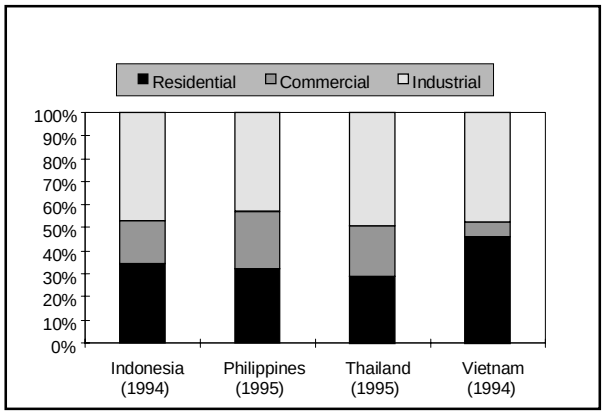
The more developed economies, such as Japan, Korea, and Singapore, use up to ten times more energy per capita than less developed Asian countries.[11] At the same time, the energy intensity of the less developed countries (measured in energy used per unit of Gross Domestic Product), is several times higher than that of the developed economies. The reason is that less developed economies have less efficient infrastructure and technologies for their buildings and factories. This dilemma reveals two opportunities: 1) reduce per capita energy demand in developed countries and 2) decrease the energy intensity sectorally in developing countries.

This latter opportunity deserves immediate attention since both the population and quality of life is expected to rise rapidly in developing countries. There is a window of opportunity to leapfrog--perhaps technologically, and certainly in the sequence and timing of policy implementation--over the mistakes of more developed nations by "getting it right the first time." In other words, developing nations which install energy-efficient infrastructure will profitably avoid the expense of future retrofits.

Sectoral Breakdown of Electricity Consumption

Figure 2 illustrates the electricity consumption by the industrial, commercial and residential sectors of Indonesia, Philippines, Thailand and Viet Nam. In all four countries, the industrial sector accounts for nearly half the electricity consumed. The residential sector also consumes a large part of the total, averaging about 30 percent for the four countries. The commercial sector consumes the least amount of electricity.

Figure 2. Electricity Consumption



Within the residential sector, cooling appliances such as refrigerators and air-conditioners are responsible for a large part of the electricity consumed. A significant amount is also

[10] Silver and du Pont.
[11] UN-ESCAP, p7.

expended by lighting equipment. Figure 3 shows a breakdown of electricity end-uses for the residential sector. The use of air-conditioners, refrigerators, televisions and other electronic devices are expected to rise as the quality of life quickly improves in Asia.

Figure 3. Electricity End-Uses[12]

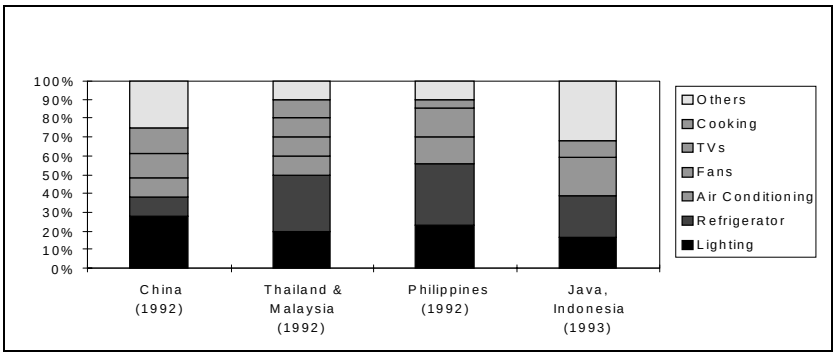
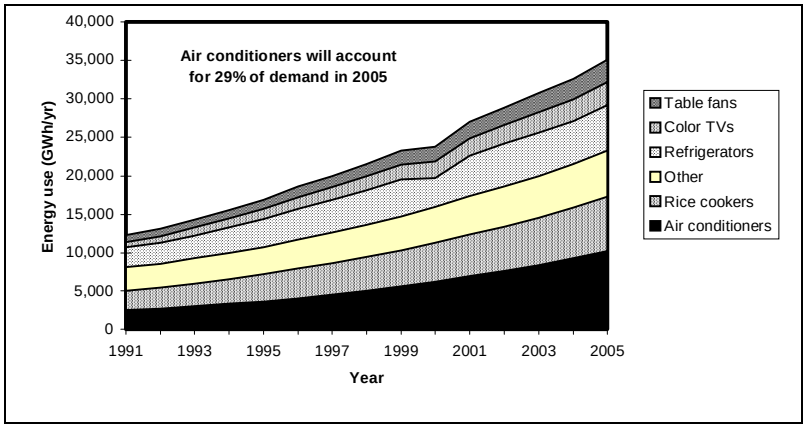


Figure 4 shows the forecast of electricity demand for the residential sector in Thailand. As mentioned, electrical appliances will become more and more common in households across Thailand, and all throughout Asia, as quality of living rises.

Figure 4. Forecast of Residential Electricity Demand, Thailand[13]

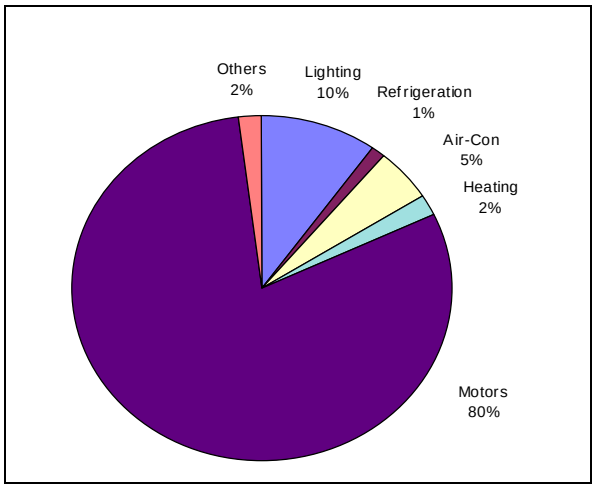


Consumption by Industrial Motors

The industrial sector is the most consuming of all three sectors. Within the industrial sector, most of the electricity is consumed by motors. As an example, a breakdown of the end-uses for Thailand's industrial sector is shown in Figure 5. This breakdown is not atypical for most developing Asian countries.

[12] Viet Nam data from: Hagler Bailly Services, pp 2-3.
[13] Thai Load Forecast Subcommittee, "Load Forecast for the Thailand Electrical System. Volume 2." Bangkok, Thailand: 1993.

Figure 5. A Breakdown of Electricity End-Uses for the Industrial Sector in Thailand[14]



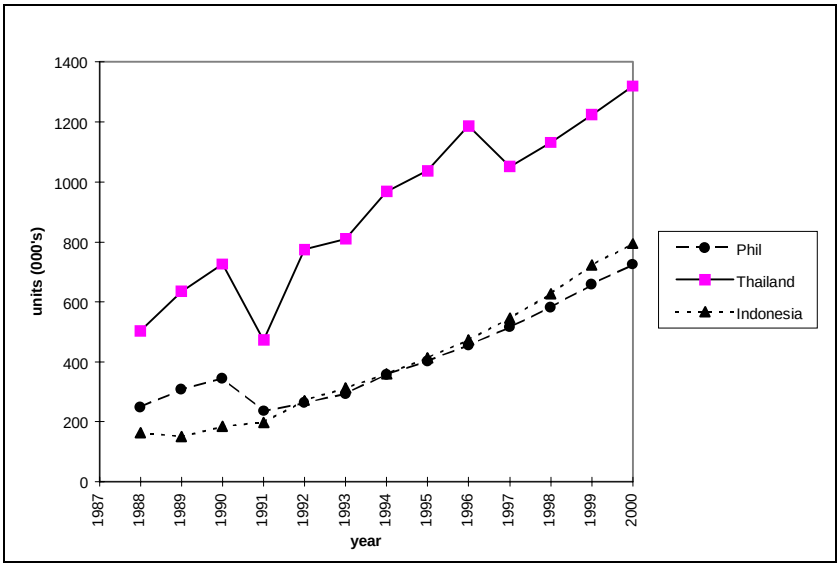
Consumption by Household Appliances

A significant portion of residential electricity demand is attributable to household appliances. Some of the first items families buy are appliances. For example, for refrigerator-owners in the Philippines, at least 25 percent of the family's electric bill is devoted to running a refrigerator. Demand for energy-consuming products promises to rise. As the quality of life increases, so will the consumption of appliances, such as refrigerators and air-conditioners. In fact, the white goods market in Asia is predicted to expand by 35 percent between 1992 and 2000, accounting for almost one-quarter of the world market.[15]

Current saturation levels for air-conditioners are quite low throughout Southeast Asia, and in some places, saturation is low for refrigerators too. For example, in the greater Bangkok area, 87 percent of residences have refrigerators and 58 percent own air-conditioners; 50 percent of homes outside of Bangkok have refrigerators and a mere 3.4 percent have air-conditioners.[16] Figure 6 and Figure 7 show projected rates of sales growth for refrigerators and air-conditioners in three of Southeast Asia's largest markets—Thailand, the Philippines, and Indonesia. These figures are not adjusted for the recent economic downturn in the region due to unavailability of revised data, however, the upward trend is unambiguous.

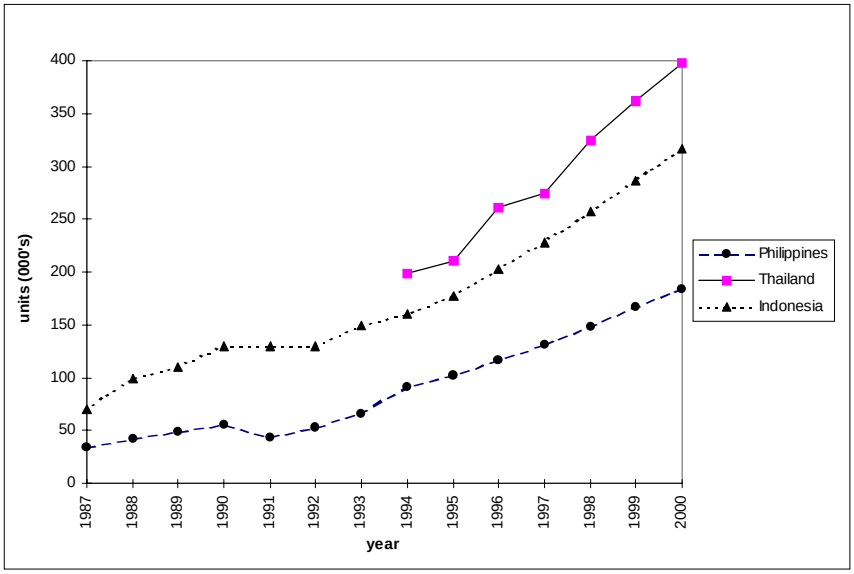
[14] Sommai Phon-Amnuisuk, Copper Development Center of Southeast Asia. "Industrial Motors and Demand-side Management." Prepared for Asia Regional Forum on Energy Efficiency Standards and Labeling, Bangkok, Thailand:1997.
[15] Turiel, p 3.
[16] IIEC, 1995, p29.

Figure 6. Refrigerator Sales[17]



The saturation of air-conditioners units is increasing rapidly at a rate of about 13% per year in rural areas and 4% in urban areas. Thus, air-conditioners will be the driver behind residential demand growth in Thailand, accounting for 29 percent of the demand by 2005.[18]

Figure 7. Room Air-Conditioner Sales[19]

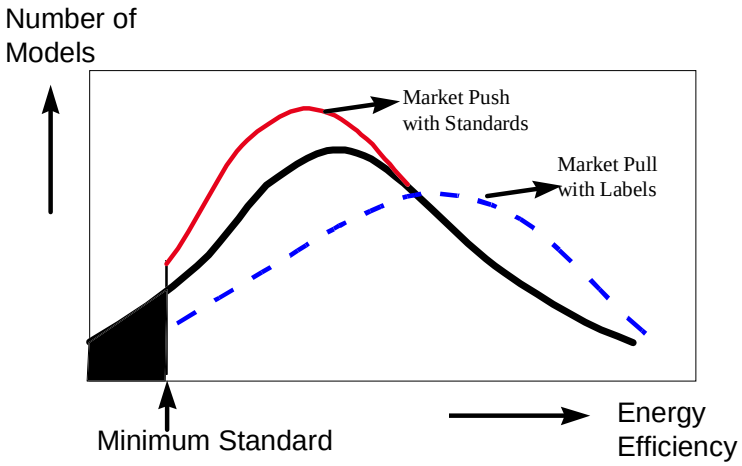


[17] Egan, November 1997. The data are historical up until 1994. The data after 1994 are projections.
[18] du Pont, 1998.
[19] Egan, November 1997. The data are historical up until 1994. Data after 1994 are projections.

Tools of Market Transformation

Standards and labeling are tools for transforming the market, shown in Figure 8. Without standards or labels, the efficiency of electrical equipment and appliances follow the solid-black curve, with most models having only medium efficiency. Establishing a minimum efficiency standard "pushes" the market by eliminating the least efficient models. To maintain sales and revenue, manufacturers are forced to produce more of the models that pass the minimum energy performance standard. Setting a standard does not result in higher production of high efficiency models; most models will still be medium efficiency.

Figure 8. Pushing and Pulling the Market



Market "pull" and market "push" are complementary market transformation strategies.

Energy labeling encourages customers to purchase energy-efficient products. This will indirectly encourage manufacturers to produce and market more efficient models, thus, "pulling" the market towards high efficiency. As a result, of the complementary market "pull" and market "push," the average energy performance of models on the market improves. Standards and labeling can be used together to achieve market transformation.

Benefits of Standards and Labeling

Standards and labeling are being pursued by Asian leaders for a variety of reasons, including to:

- benefit the economy
- protect foreign reserves
- improve local environments
- participate in international efforts to mitigate climate change

- participate in international efforts to enhance free trade

Increasing numbers of policy-makers in the Asian region recognize energy standards and labels as the premier policy tools for promoting energy efficiency. Not only are standards and labeling powerful tools, but they've also proved inexpensive.

Investment in efficient products reduces end-users' energy bills, thus improving the profitability of local businesses and industries, which in turn bolsters employment.[20] For example, U.S. efficiency standards programs for a variety of appliances have already saved each household US$200 per year[21] and have economic benefits one thousand times more than the costs.[22] The programs are projected to displace 15,500 MW of generating capacity by the year 2000.[23]

The short-term costs to equipment producers and up-front costs to consumers often make establishing standards and labeling programs controversial. Manufacturers have to retool factories and consumers sometimes, but not always, pay higher purchase cost for more efficient equipment. In the long-term, consumers save money because operating costs are lower for efficient equipment. Consumers may be paid back the cost differential for efficient equipment in as little as one year. Moreover, in some places, like Australia, there is a weak link between purchase price and efficiency.

Contrary to popular belief, standards and labels often have a neutral, or sometimes positive, impact on manufacturers.[24] This is particularly true for Asian manufacturers who can expand their markets domestically, regionally and internationally if their products meet higher energy performance levels. Manufacturers in several countries have reported to IIEC their desire for standards and labeling. In the Philippines, the Association of Home Appliance Manufacturers has been one of the main drivers behind the mandatory national standards and labeling program.[25] The local manufacturers believe that their products can compete more effectively domestically if cheap, low-quality products are prevented from being sold. The parallel Indonesian organization indicated that standards and labeling would be welcomed in Indonesia, for the same reasons.[26]

> ***Local manufacturers in Asia are often advocates of energy standards and labeling because these policies allow them to compete more effectively both at home and abroad.***

Standards and labeling offer practical, cost-effective ways to meet both local and global environmental objectives. By reducing demand for electricity, energy-efficient products defer construction of power plants, thus mitigating environmental problems associated with electricity generation. International momentum behind environmental preservation is mounting, becoming particularly acute at the recent December 1997 Kyoto Conference of the Parties 3 on the Framework Convention on Climate Change. At that forum, appliance efficiency was targeted as one of the most effective greenhouse gas mitigation options.

International trade bodies are also investigating standards-related issues. The global trend towards liberalizing trade has placed energy efficiency testing at the top of the Asia Pacific Economic Cooperation forum's (APEC) energy agenda. Both APEC and the World Trade Organization (WTO) view differences in energy efficiency testing procedures as a trade

[20] Silver and du Pont.
[21] McMahon, et al., 1996.
[22] Lawrence Berkeley National Laboratories, 1995.
[23] McMahon, et al., 1996.
[24] McMahon and Turiel.
[25] Ferreria and Bureau of Product Standards.
[26] Ferreria.

barrier. Harmonizing testing procedures or deriving ways to compare test results from different procedures addresses this barrier.[27]

Currency Crisis: Threat or Opportunity?

The recent currency crisis has presented a new threat to energy efficiency efforts. As Asian economies contract, fiscal resources in most Southeast Asian countries are scarcer than last year, and many national priorities are competing for funds. Some leaders have not understood investments in energy efficiency as a long-term economic development strategy. In fact, in fall of 1997, the government of former Thai Prime Minister Chavalit tried to use most of Thailand's US$400 million Energy Conservation Promotion Fund to offset a budget deficit until internal and external pressure from efficiency advocates forced him to restore it. Other countries have not fared so well in averting threats to energy efficiency initiatives—for example, reduced budgets have delayed the promulgation of energy efficiency regulations, including energy labeling requirements, in Malaysia and have postponed the construction of testing infrastructure in Indonesia.

However, leaders in several countries are redefining the Asian economic crisis as an opportunity for promoting energy efficiency consciousness and actions. Because fuel imports exacerbate the depletion of foreign exchange, the time is opportune for accelerating development of energy efficiency initiatives. For example, this past March, the directors of Thailand's National Energy Policy Office mobilized military cavalcades to escort a citizen bike ride in Bangkok to reduce fuel consumption and help the country. Saving energy has become patriotic. Particularly with standards, some key energy officials view building standards regimes as a strategy for safeguarding foreign exchange reserves and avoiding cashflow shortages by reducing fuel imports and operating costs. Energy efficiency is publicly explained as critical to long-term national economic development.

> ***Advertising media in Thailand cast saving energy as patriotic in these times of economic crisis.***

Demand for energy-consuming devices will temporarily decline as many Southeast Asian economies contract. This provides a window of time for manufacturers to adjust production lines and for governments to draft legislation and elevate public awareness about the national importance of energy efficiency.

[27] It is worth noting that introducing energy-efficiency requirements, such as mandatory standards or labels, may impede trade. APEC recognizes this and has adopted no formal platform on promoting national standards and labeling policies. It is possible that the trend towards procedure harmonization may counterbalance the effect of initiating national requirements. It is also possible that if the trend towards international cooperation on standards and labeling program continues, harmonization of standards and labels could occur in some form. This does not mean that standards would be exactly alike or labels would look the same, just that a mechanism would be established by which consumers could compare products manufactured in different countries. For more information on this topic, see Hally-Burton, Fall 1996(a).

Building Blocks of a Standards Regime

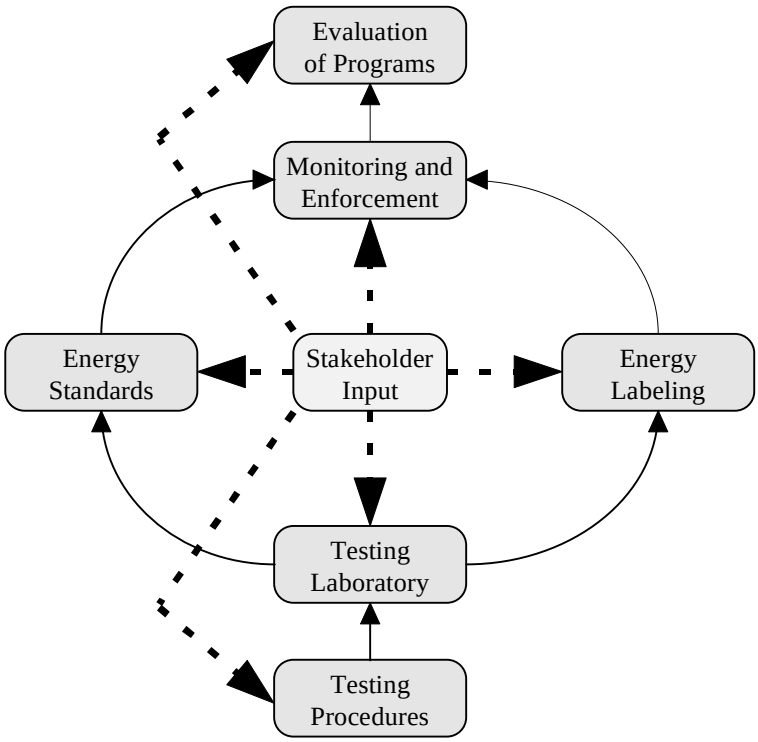
A standards regime is defined as a set of elements which ensure that energy efficiency standards and labeling efforts are effective, appropriate, progressively strengthened and sustained. The building blocks of a standards regime include:

- **Adequate and Accredited Testing Facilities.** Facilities should be internationally accredited with competent testing personnel and capacity to test models in a timely manner.
- **Appropriate Testing Procedures.** Testing procedures are the methods by which the energy efficiency level of a product is deduced. The selected procedures should reasonably reflect the usage patterns and climate particular to a country. This builds consumer confidence that test results accurately reflect the energy usage he will experience.
- **Energy Efficiency Standards.** Standards can be mandatory or voluntary and based either on maximum energy consumption or minimum energy efficiency.
- **Energy Efficiency Labels.** Standards and labeling can be established separately or as complementary programs. Many types of labeling programs exist.
- **Supportive Policies.** An energy policy framework that is conducive to energy efficiency is critical to the longevity of a national standards regime. Supportive policies include government procurement requirements, voluntary programs, "Golden Carrot"-type incentives to manufacturers,[28] consumer awareness campaigns, and demand-side management and integrated resource planning.
- **Enforcement.** Compliance with voluntary and mandatory standards and labels must be ensured through a credible enforcement scheme to ensure program effectiveness.
- **Monitoring and Evaluation.** Monitoring and evaluating the impact of the standards and labeling programs will inform program modifications, justify further activities, and provide the documentation necessary to sustain the standard regime over the long-term.
- **Ratcheting Process.** A legislative process should ensure that standards and labels are periodically reviewed and raised as the overall product efficiency on the market improves.

Figure 9 shows the building blocks for a national standards regime. Stakeholders--manufacturers, consumers, utilities and government agencies—are critical to the success of the programs. Their input ensures the regime is appropriate to the political economy of the nation.

[28] The Golden Carrot program was launched by a consortium of US utilities. A prize was offered to the manufacturer that developed a refrigerator model which exceeded the current US standard by at least 25 percent. The requirement was that the manufacturer successfully market and sell 250,000 units.

Figure 9. Components of a Standards Regime



Below, we briefly discuss four building blocks in detail—testing facility accreditation, testing procedures, standards, and labels.[29] Before discussing each building block, we briefly explore the role and importance of energy conservation legislation and regulation in building effective standards regimes.

Standards Regimes and Energy Conservation Legislation

Legislation may mandate standards and labels or may enable institutions to initiate programs. Alternatively, programs may be developed outside a country's regulatory framework.

Market intervention to promote national standards regimes can occur in a variety of ways. Law can mandate standards and labels or give the mandate to an institution to issue standards or labels. This has been the case in the United States--the nation with the second oldest standards and labeling programs. In 1978, the National Energy Policy and Conservation Act required the Federal Trade Commission to mandate labels for selected household appliances. The 1987 National Appliance Energy Conservation Act established standards. Detailed regulations codified the energy performance requirements.

Alternatively, regulations can be developed independent of particular energy conservation legislation. Lastly, standards and labeling programs can be run on a voluntary basis by governmental, quasi-governmental or non-governmental organizations. For instance, in Japan and Switzerland, standards have been established in collaboration with manufacturers, and are not codified as mandatory law. Compliance is technically voluntary, and manufacturers effectively cooperate. In Japan, this is likely due to the high level of government-industry cooperation. In Switzerland, manufacturers were informed that non-compliance would result in the issuing of a mandatory standard. An example of a voluntary labeling program is the

[29] For more information on these topics see: **For accreditation issues,** Nordicity Group Ltd. **For testing procedures,** see Meier and Hill. **For labeling**, see Casey-McCabe and Harris. **For methodologies on standards**, see Turiel, Chan and McMahon.

US Environmental Protection Agency's Energy Star program which provides an endorsement label for products which pass a specified threshold of energy efficiency.

Legislation in Korea sets standards and defines labels. In the Philippines, the programs have been developed through regulation without reference to a particular law. In Thailand and Hong Kong, the programs are voluntary. Legislation and regulation is a powerful approach to initiating programs, providing there is adequate enforcement. However, mandating standards or labels can cause contention, particularly with manufacturers. Therefore, in some countries, voluntary agreements and programs have preceded the introduction of legal mandates.

> ***In some countries, voluntary agreements between manufacturers and governments precede the introduction of legal mandates.***

Both the Thai and Philippine programs have arisen out of policy frameworks which strongly promote energy efficiency. Neither program derives from law. Despite the lack of an energy conservation law in the Philippines, government agencies have taken the cue from the Department of Energy (DOE)'s policy directive on energy efficiency, and have promulgated mandatory standards and labeling. In Thailand, the DSM program also arose out a directive from a efficiency-friendly policy environment. It is instructive that the Thai program which does not depend on specific laws or regulations, is nonetheless successful. Now that Thailand is preparing to make standards mandatory, the energy conservation law will likely play a much bigger role in the development of the national standards regime. In addition, EGAT and the Office of Consumer Protection are investigating the possibility of working together to make labels mandatory in the future. This activity would draw its mandate from the Energy Conservation Promotion Act.

We conclude that in Thailand and the Philippines, energy conservation legislation was not necessary to program initiation. Other factors, such as strong public-private collaboration in program development and support programs, such as consumer advertising, have contributed to the success of the standards and labeling initiatives. The recent surge in the codification of standards in the Philippines evidences the importance of the *process* of setting standards, which enables manufacturers to assume the challenge of developing standards and labels.

Nevertheless, policy directives have provided a conducive environment for the development of the programs. Additionally, the existence of the Energy Conservation Promotion Act in Thailand allows for a potentially smooth transition into mandatory labeling and mandatory standards. Both these activities will likely be structured to build on the strength of the voluntary labeling programs. The passage of the pending energy conservation law in the Philippines could have the same strengthening impact.

Testing Facility Accreditation

Testing laboratories must be accredited to gain international credibility and recognition of their test results. In most countries, there is a single accreditation body for laboratories that test products for performance and safety. Although there is no separate accreditation for energy-efficiency testing, current accreditation could be fairly easily extended to these specific technical areas.[30] These bodies often calibrate as well as test. Calibration is the process of making testing equipment accurate and traceable to international measurements.

> ***Government operation of laboratories can be counterproductive.***

[30] Cogan.

Accreditation is also important because it is the mechanism for assuring the accuracy of all laboratories, including those which are owned by private companies. In Asia, often governments insist on owning the testing infrastructure, reasoning that ownership is a way to control quality, accuracy, and the neutrality and independence of the laboratory. In fact, government ownership is sometimes counterproductive in several dimensions. Government ownership often limits the laboratory staff to government salaries, and limited advancement opportunities, and limits the laboratory to poor equipment. In the Philippines, income for laboratory services does not accrue directly to the laboratory; rather, it goes to the government, so that the laboratory cannot afford to replace and upgrade its equipment in a timely fashion, despite having a fee structure which would support such investments. In Thailand, low salaries have resulted in low staff retention rates.

The International Organization for Standardization (ISO) and the International Electrotechnical Committee (IEC) have set standards for accreditation systems, general laboratory competence, and laboratory proficiency testing. These are:[31]

- ISO/IEC Guide 58: 1993 - Calibration and testing laboratory accreditation systems: general requirements for operation and recognition.
- ISO/IEC Guide 25: 1990 - General Requirements for the competence of calibration and testing laboratories.
- ISO/IEC Guide 43: Development and operation of laboratory proficiency testing.

In some places, there are area-specific programs, such as environmental certification or energy efficiency testing. But this is rare in Asia. Most of the accreditation bodies fall under the national ministerial laws concerned with trade or industry. Accreditation bodies in Asia are shown in Table 1.

[31] Harrington, Bangkok,1997.

Table 1. Laboratory Accreditation Bodies in Asia

China	China State Bureau for Technical Supervision/China National Accreditation Committee for Laboratories
Chinese Taipei	Chinese National Laboratory Accreditation
Hong Kong	Hong Kong Laboratory Accreditation Scheme
India	National Accreditation Board for Testing & Calibration Laboratories
Indonesia	National Accreditation Body of Indonesia
Japan	Agency of Industrial Science and Technology Japan Accreditation Board for Conformity Assessment Japan Calibration Service System
Malaysia	Laboratory Accreditation Scheme of Malaysia administered by the Malaysian Accreditation Council
Philippines	Bureau of Product Standards Laboratory Accreditation Scheme
Singapore	Singapore Laboratory Accreditation Scheme managed by the Productivity and Standards Board
Korea	Korea Laboratory Accreditation Scheme
Thailand	Thai Laboratory Accreditation Scheme of the Thai National Standards Institute
Viet Nam	Viet Nam Laboratory Accreditation Scheme of the Directorate for Standards and Quality. This facility is just starting up.

These accreditation bodies work together through the Asia Pacific Economic Cooperation (APEC) forum in a specialized regional body called the Asia-Pacific Laboratory Accreditation Program (APLAC). APLAC's programs do not focus on energy-efficiency testing, but rather the overall quality of testing facilities.

APLAC is working towards harmonizing laboratory accreditation practices. APLAC aims to reduce technical barriers to trade, promote international acceptance of test data, and to foster Mutual Recognition Agreements (MRAs) between APEC economies. MRAs recognize equivalence of laboratories and test reports. Some bi-lateral MRAs exist. Their formation is very time-intensive and costly since it involves sending delegations to other countries within the organization to conduct evaluations of facilities.[32] A core of countries are developing a multilateral MRA. They are Australia, Hong Kong, New Zealand, Singapore and the United States. Several applications from other economies are pending.[33]

Test Procedures

Energy efficiency standards and energy labeling are based on test procedures to measure product energy consumption or energy efficiency.[34] Different test procedures are used to test the same products. Choosing a testing procedure often demands a trade-off between cost/ time and accuracy. In general, the better the test procedure reflects actual in situ energy consumption of a product, the more complicated, and hence, expensive the procedure is to perform.[35]

Test procedures measure the power input required for the product to perform at a given level. For example, an air-conditioner is placed in a chamber with regulated humidity and initial

[32] Lam.
[33] Lam.
[34] Test procedures are also commonly called "testing protocols," "test methods" or "testing standards."
[35] Meier and Hill, J.E.

temperature. The laboratory will measure the power required to cool that room to a specified temperature and maintain that temperature over a specified period of time.

Some recent developments in technology have complicated the measurements of in situ energy consumption. For instance, microprocessors which control defrosting in refrigerators or powering-down in office equipment, are not adequately measured in current testing procedures. Other power-consuming product features, such as ice-makers in refrigerators, are not operated during testing, thus skewing energy consumption test results.[36]

Test procedures are specified by both international and national standards organizations. Major standards organizations are shown in Table 2. For clarification, these organizations do not issue energy performance standards—only testing procedures.

Table 2. Standards Setting Bodies[37]

International	International Organization for Standardization (ISO)
	International Electro-technical Committee (IEC)
Canada	Canadian Standards Association (CSA)
China	National Bureau of Standards
Europe	European Committee for Standardization (CEN)
	European Electro-technical Committee for Standardization (CENELEC)
Japan	Japan Institute of Standards (JIS)
Australia	Standards Australia
New Zealand	Standards New Zealand
United States	Association of Home Appliance Manufacturers (AHAM)
	American National Standards Institute (ANSI)
	Air-Conditioning and Refrigeration Institute (ARI)
	American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
	American Society of Mechanical Engineers
	Illuminating Engineering Society of North America

Many national testing procedures reference ISO or IEC testing procedures. In some instances, the procedure is adopted exactly. In other cases, national standards organizations have developed quite distinct testing procedures.

At present, it is nearly impossible to compare test results derived from different testing procedures. No accurate cross-walk between procedures has been developed to date, although some research has been done to show how the same product tests under different procedures.[38]

Refrigerator Testing Procedures

Refrigerator testing procedures vary greatly—differing from whether models undergo door openings to the ambient temperature in which models operate to whether models should be loaded with "fake food". The most significant differences between procedures are in required ambient and compartment temperatures.[39]

Nevertheless, national testing procedures can be grouped into two categories. The European Union, most of Southeast Asia, Australia, and Japan use procedures which reference ISO. North America uses a procedure which references the US Department of Energy procedure.[40]

[36] Turiel, p 14.
[37] Duffy, p 53.
[38] Research has compared JIS/DOE procedures for refrigerators. See Rosenquist, 1997(b).
[39] Meierand Hill, p 15.
[40] Rosenquist, 1997(b).

The old JIS standard was the only one which had door openings, but this is a difficult and expensive test. Energy efficiency testing procedures for refrigerators are listed in Table 3.

Table 3. Energy-Efficiency Testing Procedures for Refrigerators

International	refrigerator	ISO 7371-1985 (and Amendment 1-1987)
	refrigerator-freezers	ISO/DIS 8187.3-1991
	freezers	ISO 5155:1983
	frost-free	ISO 8561: 1996
USA		U.S. DOE and ANSI/AHAM HRF-1-1988
Japan		JIS 9607 (1986)
Australia/New Zealand		AS2575.2-1989 and NZS 6205.2-1989
China		GB 12021.2-89

The four ISO refrigerator testing procedures are currently being combined.[41] ISO procedures are oriented towards smaller refrigerating appliance models with less features than the Japanese or North American procedures. The ISO procedures have tropical and temperate temperature test points.

> ***The four ISO refrigerator testing procedures are currently being combined***

Table 4 shows the differences between test procedures to measure refrigerator-freezer energy consumption.

Table 4. Refrigerator-Freezer Energy Consumption Test Procedure Parameters[42]

Parameter	ISO	JIS	U.S.	Australia/NZ	China
Ambient Temperature	25°C	15 & 30°C	32.2°C	32°C	30°C
Fresh Food Compartment	5°C	3°C	3.3°C	3°C	3°C
Freezer Temperature	-18°C	-18°C	-15°C	-15°C	-18°C
Door Openings	No	Yes	No	No	No
Loading	Yes	No	No	No	No

Air-Conditioner Testing Procedures

For room air-conditioners, most countries use a procedure similar to ISO5151 for non-ducted (window, wall and mini-split) units. For the ducted units (central air-conditioners), the common test procedure is ISO13253. The United States categorizes air-conditioner types differently. The U.S. DOE uses the one procedure to test window and wall units and another to test mini-split and central air-conditioner units. The Japanese test procedures categorize air-conditioners the same way as the ISO procedures. These major testing procedures are listed in Table 5.[43] The US Department of Energy (DOE) test procedure also differs from the ISO procedure in that consumption is measured at several temperature points to reflect seasonal variations. ISO has two ambient temperature test conditions: 25°C for temperate and subtropical climates; 32°C for tropical climates.

[41] Asian GRoup for Energy Efficiency.
[42] Turiel, Kollar, and McMahon.
[43] Rosenquist, Bangkok, 1997.

Table 5. Air-conditioner energy-efficiency testing procedures

International	Non-Ducted (window, wall and mini-splits)	ISO 5151
	Ducted (Central A/C)	ISO 13253
U.S. DOE	Non-Ducted (window and wall)	ANSI/AHAM RAC-1-1982 and ASHRAE 16-1983 RA88
	Ducted (mini-split and central A/C)	ARI 210/240-89 and ASHRAE 37-1988
Japan	Non-Ducted (window, wall and mini-splits)	JIS C 9612-1994
	Ducted (central A/C)	JIS B 8616-1993

Industrial Motor Testing Procedures

There are two dominant testing procedures for electric motors -- IEC 34-2 and IEEE 112. The Japanese Electrotechnical Committee also has issued a motors testing procedure, JES-37. The efficiency of a motor when tested under the different standard conventions can vary by several percentage points.[44] Most consider the IEEE 112-Test method B to be the most accurate test for energy efficiency.

Efficiency testing procedures differ primarily in their treatment of stray load losses. A recent study by Dr. Arun Mitra of Compton-Greaves India seems to indicate that stray load losses are due to variations in electricity supply, rather than motor design. If true, this would be an important factor in countries such as India, where extreme variability in the quality of electricity supply is common.[45] The IEEE 112-Test method B determines stray load loss through an indirect process, whereas the IEC standard assumes stray load losses to be fixed at 0.5 percent of input and the JEC standard assumes there are no stray load losses.[46]

The National Electrical Manufacturers Associations (NEMA), based in Washington, D.C., sets minimum efficiency baselines for defining energy efficiency motors. NEMA has adopted IEEE 112 method B as its efficiency testing standard.

Testing Procedures for Other Products

For lighting equipment, IEC is the testing procedure most widely used. IEC has issued the following test procedures for fluorescent lamps and fluorescent lamp ballasts: IEC 81/82, IEC 901; IEC 920/921; IEC 928/929, IEC LM66-1991. For incandescent lamps, the IEC procedure is IEC 64.

Testing procedures for office equipment often go out of date very quickly due to the rapid development of technologies. The American Society for Testing Materials and the Swiss Federal Office of Energy have developed procedures for photocopiers and faxes.[47] Testing procedures for a variety of other products are listed in Table 6.

[44] Phon-Amnuisuk, 1997(b).
[45] Cogan.
[46] Asian GRoup for Energy Efficiency.
[47] The American Society for Testing Materials procedure for copiers assumes a work day of about 9.5 hours, and that copiers are turned off at the end of the day; jobs are batched based on number of copies per month and per day. The test monitors aggregate energy use, including all energy using modes (warm-up, active, standby, low-power, recovery, and plug-in). The Japanese government has an even simpler test for its copier regulation. The test measures energy over the following steps: turn the machine on, make the prescribed (based on copier speed) number of hourly copies, let it go into any energy saving modes; do the same for a second hour, but without the cold start turn-on.

Table 6. Various Testing Procedures for Other Products

Product	Existing Testing Procedures
Clothes Washers	IEC 456 JIS C 9806 ANSI/AHAM HLW-1, HLW-2EC, DOE CFR II part 430
Clothes Dryers	IEC 1121 JIS S 2130 ANSI/AHAM HLD-1, HLW-2EC, DOE CFR II part 430
Dish Washers	IEC 436 ANSI/AHAM DW-1, DOE CFR II part 430
Cooking	CENELEC HD 376.S2 (electric-only) ANSI/AHAM ER-1
Microwave Ovens	IEC 705
Water Heaters	AS 1056.1 & 1056.4; NZS 4602, 4606 (electric) AGA Code AG 102 (gas)

Testing Procedure Harmonization

Many Asian countries import products from Europe, North America, Japan and other Asian countries. Test results are not comparable across borders. Internationally harmonizing testing procedures allows for consumers to compare models tested in different countries. Manufacturers also desire harmonized testing procedures because their products must only be tested once, thus cutting the expense of shipping sample units to several testing laboratories and paying test fees. APEC, Association of Southeast Asian Nations (ASEAN) and the Asian GRoup for Energy Efficiency are organizations promoting international harmonization of testing procedures.

> ***APEC, ASEAN and the Asian GRoup for Energy Efficiency are organizations promoting international harmonization of testing procedures.***

International harmonization of refrigerator testing procedures is unlikely, although the potential for international agreement is higher in recent years because Japan is no longer testing exclusively to the JIS procedure.

The potential for international harmonization for air-conditioner testing procedures looks promising. Most countries now use ISO 5151 condition T1 to rate the performance and energy consumption of air-conditioners.

For electric motors, the world is moving towards one testing procedure. In a landmark announcement at the International Conference on Energy Efficiency Improvements in Electric Motors and Drives held in Lisbon in October 1996, the European Commission said it will review IEC 34-2 to overcome deficiencies.[48] Many expect that the new IEC procedure will closely resemble the IEEE 112 testing procedure.

For lighting equipment, most countries use IEC testing procedures. This is true for microwave ovens as well. Some other products which are tested by the same procedure worldwide include televisions and photocopiers.[49] Other products present more difficulties for harmonization. It is difficult to design a common and accurate testing procedures for products for which energy consumption is highly dependent on the difference in usage patterns. For instance, with washing machines, there is no single, widely established testing

[48] Asian GRoup for Energy Efficiency.
[49] Turiel, p 3.

procedure because energy consumption depends on type of detergent is used, whether a dryer is used afterwards, and the amount of water used.[50]

Countries test appliances under differing protocols. This hampers consumer comparisons of efficiency levels of internationally traded products and makes it more difficult for local manufacturers to expand export markets. This barrier is currently being addressed by several organizations. APEC energy ministers agreed to "pursue a multilateral approach for the acceptance of results from accredited energy efficiency testing facilitates" and will work towards aligning energy efficiency testing procedures "where practicable."[51] The APEC Steering Group on Energy Standards just completed a study entitled "Energy Efficiency Performance Testing and Conformity Assessment in APEC Member Economies" which can serve to facilitate mutual recognition of testing results.

Scan of Procedures Used in Asia

In Asia, ISO and IEC testing procedures are predominantly used, and will likely become even more predominant as Japan switches from JIS towards the international procedures.[52] Table 7 lists the *reference* testing procedures used by the twelve Asian economies discussed in this paper. Most of these countries have issued national procedures, some of which reference international procedures.

Table 7. Reference Testing Procedures Used in Asia

	Refrigerators	RAC	Split AC	Motors	Lamps and ballasts
China	AHAM	ISO		IEC	IEC
Hong Kong	ISO	ISO	ISO		
India					
Indonesia	ISO	ISO		none	
Japan	ISO & JIS	ISO	ISO	JIS	IEC
Korea	JIS		JIS	IEC	IEC
Malaysia	none	none	none	none	none
Philippines	ISO	ISO	ISO	none	IEC
Singapore	none	none	none	none	none
Taipei China					
Thailand	ISO	ISO	JIS	IEC[53]	IEC
Viet Nam	none	none	none	none	none

Existing testing procedures have been criticized by various experts. At a recent technical colloquium of testing procedure experts from Asian nations, AGREE participants issued recommendations on how to modify existing testing procedures for air-conditioners, refrigerators, and electric motors to improve accuracy and reflect conditions particular to Asia.[54]

Energy Efficiency Standards

Energy efficiency standards eliminate the least efficient products from the market. The profound market transformation witnessed in the United States is mostly attributable to the

[50] Meier and Hill, p.27.
[51] APEC Energy Ministers.
[52] Nakagami and Litt.
[53] EGAT uses NEMA IEEE 112 for its motor financing program.
[54] The full recommendations can be found on IIEC's website: www.iiec.org.

strict standards set by the government. In fact, some argue that standards are the most powerful method for improving the overall efficiency of products on the market.[55]

> ***Standards are the most powerful method for improving the overall efficiency of products on the market***

A key element of a standards regime is building-in a process for periodic review and adjustment of the standard. This allows continual ratcheting of the standard in an upward direction and forces continual product efficiency improvements. The importance of incorporating this ratcheting mechanism cannot be overstated. The most effective standards regimes have regularly scheduled review processes. The scheduled processes give manufacturers planning certainty which is important to their success at product development and marketing. Because the standard will be revisited, less pressure exists to "get the standard right the first time." A process of continual revision allows more latitude in negotiating the standard to be implemented. This latitude facilitates shorter standard-setting processes and keeps the parties to the negotiation from reaching impasses which fundamentally defeat the reason to have standards.

Energy standards can take a couple of forms. They can specify maximum energy use or minimum energy efficiency levels or average sales weighted values.[56] Energy standards can be either performance-based or prescriptive, such as specifying a certain feature's presence or absence on a product.

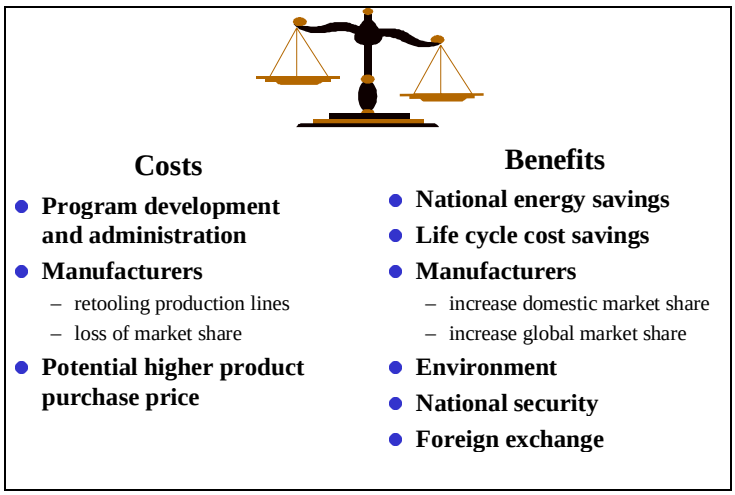
Standards programs can be designed in a variety of ways:

- **High vs. low:** Energy efficiency standards can be set at high (strict) levels or lower levels. The profound market transformation witnessed in the United States is mostly attributable to the strict standards set by the government.
- **Voluntary vs. mandatory:** Most countries establish mandatory standards, however, Switzerland and Japan have successfully implemented voluntary ones. In Japan, this is likely due to the high level of government-industry cooperation. In Switzerland, manufacturers were informed that non-compliance would result in the issuing of a mandatory standard.
- **Statistical vs. engineering analysis method:**[57] The level of standard can be selected through several methodologies. A statistical analysis method selects the level of standard by investigating the types and number of models on the market, and selecting a target percentage of products to eliminate. The engineering approach is more sophisticated and data-intensive, involving a cost-benefit analysis which incorporates costs of modifying products and impacts on the environment, manufacturers, consumers, and national energy balance. In Asia, analysis is typically presented to technical stakeholder committees who then determine through discussion an appropriate energy efficiency standard. Sometimes, standards are set without reference to analysis.

Figure 10 lists the costs and benefits to be considered when devising standards.

[55] Waide.
[56] Turiel, p 8.
[57] See also Rosenquist, 1997(a).

Figure 10. Weighing the Costs and Benefits of Setting Standards



Energy Labeling

Energy labels are the cornerstone of market pull strategies for energy efficient equipment. Labels communicate directly with consumers, providing information to consumers regarding the energy efficiency or energy performance of products. This reporting creates a second price tag, alerting consumers to the lifetime operating cost of the product. By conveying previously unknown product information to customers, labeling programs can enlarge market demand for efficient products.

> ***Energy labels create a second price tag, alerting consumers to the operating cost of the product over its lifetime.***

It is critical that the design of the label be easily understandable to the average consumer. It is also critical that the design of the labeling program be appropriate to a particular country's context. The elements of a successful labeling program are a well-designed label that consumers can easily understand; a base of manufacturer support for the program; an aggressive promotional campaign utilizing television and other mass media; and a consumer evaluation phase in which consumer feedback is used to improve the design and effectiveness of the labeling program.

Labeling programs can be designed in a variety of ways:

- **Voluntary vs. mandatory:** Unlike with standards, many voluntary programs exist. Some have garnered widespread manufacturer participation, like in Thailand. Others have not. Mandatory programs ensure that consumers can compare all products before purchase.
- **Independent vs. associated with standards:** Some labeling programs may be associated with energy efficiency standards, others may operate independently.
- **Program administered:** Programs can be administered by governments, utilities, manufacturers, consumer groups, or other independent parties. A study by the US Environmental Protection Agency found that US consumers trusted the government most for conveying accurate information. Appropriate program administrators will vary country-by-country.

Labels may compare a particular model to others on the market or endorse a model as having passed a minimum threshold of energy performance. Five distinct categories of labels exist.[58] Many labels combine characteristics from the different categories.

The design of a label is critical to the success (or failure) of a labeling program. Labels must effectively communicate with consumers. In many cases, labels have been designed by engineers or technicians without any input from marketing experts. In the United States, this mistake has severely limited the impact of the labeling program. Data suggest that between 13 percent and 43 percent of consumers could not correctly interpret the label.[59] The importance of convening consumer focus groups and soliciting the advice of marketing professionals cannot be overstated.

> ***The importance of convening consumer focus groups and soliciting the advice of marketing professionals on label design cannot be overstated.***

Energy labels often have information on monthly or annual energy consumption, operating cost, or a model's rating against others in its class. The accuracy of the label depends on the ability of the testing procedure to replicate actual product usage. Other product information--such as cooling capacity for air-conditioners--is also reported.

Five types of energy labels exist. Each type has a slightly different purpose. The effectiveness of a particular label depends on the label design, how it is marketed and promoted, and the desired behavioral outcome on either the part of either manufacturers or consumers.

Endorsement labels

Endorsement labels certify that the product's efficiency lies above a designated threshold.

Characteristics:

- Seal of Approval
- Typically target top 15%-20% of models on market
- May explain criteria for certification
- Success in United States with computers with Energy Star
- After initial market change, impact is limited

These labels offer a "seal of approval" that a product meets certain pre-specified criteria. Labels generally are based on a "yes-no" cutoff, and offer little additional information. An example of an endorsement label for energy efficiency is the U.S. Energy Star™ label, which was originally applied to office equipment, and has recently begun to be adopted for four types of appliances as part of a national pilot project. Endorsement labels are typically applied to the top-tier of products in a market.

[58] In our definition of energy labels, we do not include certification marks that confirm that a product has met a mandatory energy standard.
[59] du Pont, 4 December 1997.

Figure 11. Endorsement label: US Energy Star

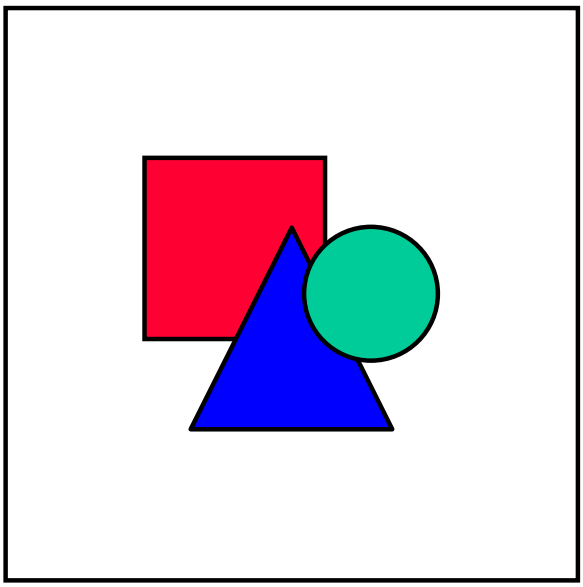


Figure 12. Endorsement label: Ireland washing machine

Comparison Labels

This type of label allows consumers to compare energy consumption between models. There are two types of comparison label—categorical and continuous.

The categorical comparison label uses a categorical rating or ranking system to establish clear categories that show which products are poor, average, above average, or superior. The consumer can tell, by looking at a single label, how energy-efficient the product is relative to others in the market. The labels may or may not also contain detailed information on the operating characteristics, costs, and energy use of the models. Examples are the European Union's refrigerator labels which have a rating scheme from A to G; the Korean and Thai appliance energy labels, which have a rating

Categorical Comparison

Comparison categorical labels allow consumers to easily "comparison shop" by categorizing a product's energy efficiency.

Characteristics:

- Labels explicitly rank models against one another
- Provides basis for comparison shopping, easy for consumer
- Rankings by number scales or stars

scheme from 1 to 5; and the Australian appliance labels, which have a rating scheme from 1 to 6 stars.

Figure 13. Categorical Comparison label: Korea Refrigerator

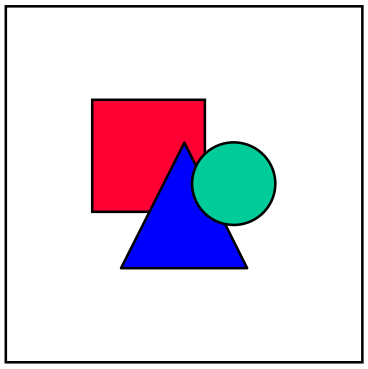


Figure 14. Categorical Comparison label: European Refrigerator

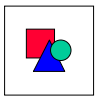
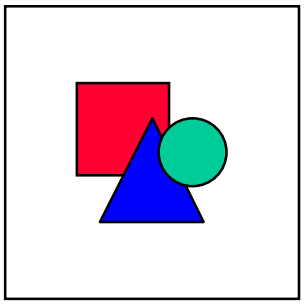


Figure 15. Categorical Comparison label: Australian Clothes Washer



Continuous Comparison

Continuous Comparison

Continuous comparison labels allow consumers to "comparison shop" by providing information on low and high efficiencies.

Characteristics:

- Models compared using continuous scales, like shaded bars
- Provides basis for comparison shopping, but makes consumer work harder

Continuous comparison labels provide detailed information on the energy performance of the product through a continuous scale, such as a shaded bar. The scale may provide information that forms the basis of a comparison with other models, but does not use specific categories to accomplish this. Examples are the U.S. EnergyGuide and Canadian Energuide labels, which show a dollar or kWh amount of annual energy usage as well as a scale that shows relative energy use compared to other products.[60]

[60] Excerpt from du Pont, 1998.

Figure 16. Continuous Comparison: US Refrigerator (old design) highlighting yearly operating cost

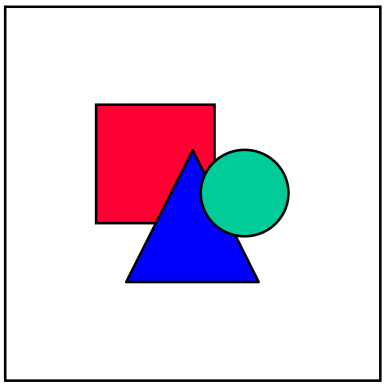
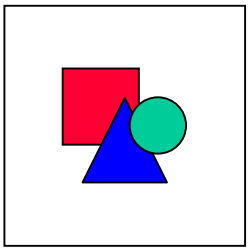


Figure 17. Continuous Comparison: US Dishwasher (new design)



From the consumer's point of view, the difference between "comparative with categories" and "comparative with detailed information" is crucial. The former establishes clear categories, so that the consumer can tell, by looking at a single label, how energy-efficient it is relative to others in the market.

One problem to prevent is clustering of models around the highest ranking. Labels, like standards, must be periodically adjusted to allow for product efficiency on the market to continually improve. In Australia, many models have reached the highest rank, and the efficiency of products on the market has ceased to improve. This "clustering" of models can be avoided by initially structuring the label categories with enough room at the top ranks for models to gradually fill them and by periodically redefining and upgrading the efficiency required to obtain the higher ranking levels.

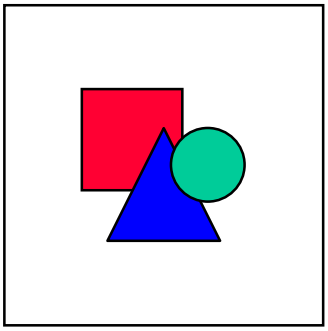
> ***"Clustering" of models at the best label rating can be avoided through periodic revision of the label scale.***

Detailed Information

A detailed information label lists information on product energy performance, but does not provide information directly comparing the product to other products.

Provides information on:
- Energy consumption
- Energy efficiency rating; or
- Operating cost (annual or monthly)

Figure 18. Detailed Information: Philippines Air-Conditioner



Eco-labeling

Eco-labels endorse products based on a range of environmental criteria. Often, the criteria includes energy performance.

Eco-labels typically base endorsement or ranking on the overall environmental performance of a product—from "cradle to grave." Factors considered include environmental impact from pollution, type of materials used, and waste disposal.

Characteristics:

- Endorsement or Report Card format
- Energy is one of many criteria
- Involves value judgments
- 20-plus programs exist internationally
- Energy efficiency and other environmental criteria may conflict
- Danger-- too many labels may confuse consumers

Eco-labeling efforts in Asia will be mentioned in each of the country discussions. However, it is noteworthy that a Global Eco-labeling Network has recently been formed, with several Asian members, including Taipei China, Japan, and Korea. The network functions as an association of national environmental labeling programs, and works to facilitate information exchange, set product standards, and promote eco-labeling.[61] Greenseal, a US-based independent group, also has established eco-labeling criteria for refrigerators, freezers, clothes washers, clothes dryers, dishwashers and ovens.[62]

[61] http://www.interchg.ubc.ca/ecolabel/gen.html
[62] Weissman.

Figure 19. Ecolabel: US Greenseal

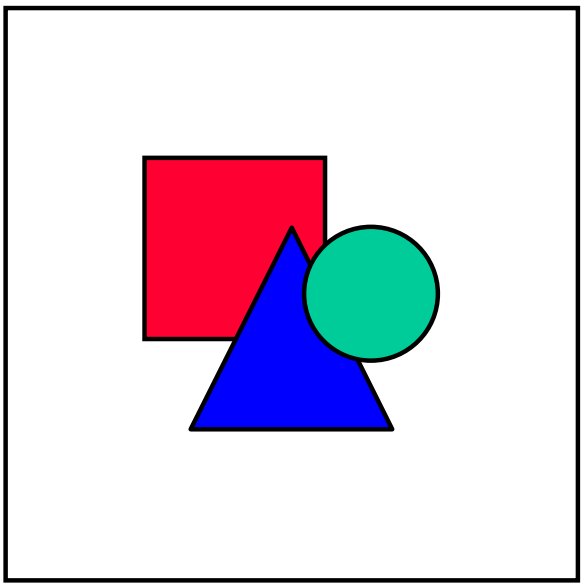


Figure 20. Ecolabel: Europe, placed on energy labels to indicate high environmental performance

Summary of Status of Labeling and Standards Activities in Asia

There are several well-established standards and labeling programs in Asia, and others currently under development. Japan, Korea, and Taipei China have long-standing programs. Among the ASEAN nations, the Philippines and Thailand are the strongest leaders for the promotion of energy efficiency standards and labeling for electric appliances and equipment. Other efforts exist in China and Hong Kong, and only weak standards for one product exist in India and Singapore. Malaysia, Indonesia and Viet Nam are currently considering establishing programs.

Table 8 summarizes appliance labeling and standards activities Asia.

Table 8. Summary Matrix

Country	Products	Standard?	Label?	Label Type if applicable
China	central air-conditioners	● M (1989)		
	room air-conditioners	● M (1989)		
	clothes washers	● M (1989)		
	fans	● M (1989)		
	irons	● M (1989)		
	radio receivers and recorders	● M (1989)		
	refrigerators	● M (1989)		
	rice cookers	● M (1989)		
	TVs	● M (1989)		
Hong Kong	refrigerators		● V (1995)	detailed information
	room air-conditioners		● V (1996)	detailed information
	washing machines		● V (1997)	detailed information
India	air-conditioners	● V		
	refrigerators	● V		
Indonesia				
Japan	computers	● V (1994)		
	copiers	● V (1994)		
	fluorescent lamps	● V (1994)		
	heat pumps	● V (1994)		
	magnetic disk units	● V (1994)		
	refrigerators		●	information
	room air-conditioners	● V (1979)		
	TVs	● V (1994)		
Korea	ballasts		● M	categorical comparison
	boilers		● M	information
	central air-conditioners	● M	● M (1992)	categorical comparison
	room air-conditioners	● M	● M (1992)	categorical comparison
	fluorescent lamps		● M	categorical comparison
	industrial motors		● M	categorical comparison and endorsement
	passenger cars		● M (1992)	categorical comparison
	refrigerators	● M	● M (1992)	categorical comparison
	space heater		● M	information
	water heaters		● M	information
Malaysia	industrial motors	● M (1989)		
Philippines	room air-conditioners	● M (1993)	● M (1993)	detailed information
Singapore	air-conditioners	● M		
Taipei China (Taiwan)	ballasts	●		
	central air-conditioners	● (1987)		
	room air-conditioners	● (1981)		
	clothes dryers	● (1983)		
	electric motors	●		
	fans	● (1982)		
	fishing boat engines	●		
	range hoods	●		
	ranges	●		
	refrigerators	● (1986)		
	stoves/ovens	● (1983)		
	water heaters	● (1983)		
Thailand	industrial motors		● V (1997)	eco-label
	refrigerators		● V (1994)	categorical comparison
	room air-conditioners		● V (1995)	categorical comparison
Viet Nam				

M=mandatory; V=voluntary

China

Summary

In 1989, the People's Republic of China established non-rigorous standards for eight residential products, including refrigerators, clothes washers, and room air-conditioners, as well as some less energy-consuming products such as fans, rice cookers, televisions, radio receivers and recorders, and irons.[63] The Chinese State Bureau of Technology Supervision (SBTS) is currently drafting new refrigerator standards, and considering a proposal for new air-conditioner standards. There is no labeling apart from some endorsement eco-labels. There are no minimum energy performance standards for industrial motors, although there are standards for industrial systems that employ motors, as well as other commercial and industrial equipment.

Energy Policy and Institutions

The SBTS has responsibility for establishing efficiency standards on household appliances in China. The standards are recommended to the SBTS by a technical committee called National Energy Standardization Technology Commission which works with ministries, manufacturers, and universities. The legislation then must be passed by the People's Congress. Standards for motor usage were formulated by the National Energy Basis and management Standardization Technology in 1991.[64]

In 1989, minimum energy performance standards were established for eight household products. The technical committee derived the standards through a consensus process with manufacturers. No engineering or statistical analyses were performed. The committee issued draft standards, and solicited comments over a period of four months. The standard was then implemented a year after the comments were gathered. The draft for new refrigerator standards soon to be submitted to the People's Congress, was also drafted by the Technical Committee using the same process.[65]

> ***Minimum energy performance standards exist for eight household products***

The Energy Conservation Law was passed in November 1997. It requires agencies to develop energy performance standards, but it does not specify which ones. Regulations will have to be developed at a local level to implement the law. Provinces and local areas could implement their own standards. The standards legislation that now exists is separate from the new Energy Conservation Law, and is national in level.

Testing Facilities

In China, 29 facilities conduct energy efficiency tests.[66] Energy efficiency testing is conducted for refrigerators, refrigerator-freezers, freezers, room air-conditioners, industrial motors, fluorescent lamp ballasts, clothes washers, fans, microwaves, and rice cookers.[67]

Three laboratories test for energy efficiency of household appliances in China. These are the Beijing Household Appliance Research Institute, the Shanghai Household Appliance

[63] Turiel, p 9.
[64] Xin, 1994, p 5.
[65] Xin, December 1997.
[66] Nordicity Group Ltd., p 56.
[67] Nordicity Group Ltd., pp 69-70.

Research Institute, and the Guangzhou Household Appliance Research Institute. Each lab is well-equipped with machinery from Japan, Germany and some from the US and has a staff of approximately ten. The labs maintain their operation using manufacturer's fees. For now, these laboratories are adequate for handling the testing load.[68] Some large manufacturers also have their own testing facilities.[69]

There are separate labs for lighting equipment and for industrial equipment. The State Economic and Trade Commission has the National Energy Conservation Monitoring and Testing Management Center in Beijing overseeing local centers. Each province has it own monitoring and testing center, totaling about 10,000 staff working nationwide on testing and monitoring the energy efficiency of industrial equipment.

Testing Procedures

The Chinese energy consumption testing procedures are listed in Table 9.[70]

Table 9. Chinese Energy Efficiency Test Procedures

Tested product	Standard Code	Reference Standard
refrigerators	GB 12021.2-89	AHAM
room air-conditioners	GB 12021.3-89	ISO[71]
industrial motors		IEC[72]
electric washing machines	GB 12021.4-89	IEC
electrical irons	GB 12021.5-89	
automatic rice cookers	GB 12021.6-89	
TV sets	GB 12021.7-89	
radio receivers and recorders	GB 12021.8-89	
electric fans	GB 12021.9-89	
fluorescent lamp ballasts		IEC

Standards

Minimum energy performance standards have been set for 8 products: refrigerators, room air-conditioners, washing machines, irons, rice cookers, TVs, radios and recorders, electric fans. Table 10 details the standards for refrigerators, clothes washers, and air-conditioners and heat pumps.

The standards for the 8 products were issued in 1989, and none have been updated since. Even at the time of promulgation none of these standards were very effective, as about 95 percent of the equipment already met the standard.[73] However, there have been no evaluations, due to lack of financial resources.

In the industrial sector, standards have been set for operating systems which employ electric motors. The standard is called the Electric Motors Economic Operation standard. The technical committee believes industrial motors are already quite efficient and comparable to international efficiency levels. Therefore, no minimum energy performance standards for motors alone have been set. However, energy-saving motors receive an energy conservation product mark, and less efficient motors were banned from the market over ten years ago.[74]

[68] Xin, December 1997.
[69] Haier and Kelong have testing laboratories.
[70] Xin, November 1997.
[71] Nordicity Group Ltd., p 27.
[72] Nordicity Group Ltd., p 46.
[73] Xin, December 1997.
[74] Xin, 1994, p 5.

There are 14 industrial systems covered by standards, including boilers, pumps, ventilation, heat treatment furnaces, kilns, and the electricity supply system. These industrial standards are implemented by the SBTS and the energy conservation departments of the State Planning Commission, the State Economy and Trade Commission and other concerned ministries. In 1992, methods for calculating energy use and selecting a commercial products were developed.[75]

Standards for residential refrigerators vary as a function of volume. For a 180-209 liter refrigerator, energy use must be less than or equal to 1.3 kWh/day (475 kWh/yr).[76] The SBTS is considering a new minimum efficiency standard for refrigerators.

Table 10. Chinese Efficiency Standards for Household Appliances[77]

Product	Type/Size	Unit of Measure	Standard	
Refrigerator	189-209 liters	Max Energy Consumption	475 kWh per year	
Clothes Washers[78]	Automatic	Max Energy Consumption	38 Wh per kg of clothes	
	Two-tub with auto wash/rinse cycle control	Max Energy Consumption	32 Wh per kg of clothes	
Room Air-conditioners[79]			Window-unit	Split-system
	Watts $\leq$ 2500	Minimum COP	2.20	2.30
	2500 < Watts < 4500	Minimum COP	2.26	2.37
	Watts $\geq$ 4500	Minimum COP	2.32	2.44

Labeling

There are no energy labeling programs. If labels are introduced, they will be modeled on the European label, which corresponds to the A-D rating system of the draft refrigerator standards.[80] The Chinese have opted not to use Energy Star for refrigerators because no models meet the criteria.

In the industrial sector in Shanghai, Xinjiang and Beijing, some equipment must be certified that it passed a certain threshold energy performance level. In Beijing, CFLs, electronic ballasts, and insulation material has to be certified by the Energy Conservation Certification Committee.

An eco-labeling program, run by the National Environmental Protection Agency, began in 1997. Eco-labels exist for some energy-consuming products such as fluorescent lamps, but the labels are not widely used.

Monitoring and Enforcement

Since most products met the 1989 standards before the standards were issued, there was no need for enforcement systems. Nonetheless, some report that enforcement has not been consistent.[81] The new draft refrigerator standards are accompanied by a system of enforcement. The enforcement will be carried out at the local level by the Provincial Energy

[75] Xin, 1994, p 5.
[76] Turiel, p 9.
[77] Refrigerator energy consumption is measured at an ambient temperature of 27°C. Two-tube clothes washers consist of one bin for washing and a second for spinning. Clothes must be manually transferred from one bin to the other. Source: Turiel, Kollar, and McMahon, p 9.
[78] Turiel.
[79] Turiel.
[80] Fridley.
[81] Turiel, p 9.

Conservation Office. These offices will inspect manufacturing facilities on-site. The punishment for non-compliance is deduction of the fines from the manufacturers' accounts, and transfer of monies to the provincial offices.[82]

Impact Data and Evaluation

No evaluation of the standards has been done.

The new standard has a grading system in which A is the highest ranging down to D. Calculations indicate that about 3 percent of present models will attain an A grading; 25 percent will attain B, and 60 percent will attain a C or D.[83] This grading will not be apparent to the consumer. In sum, the new standard will disqualify between 5 percent and 10 percent of the units now on the market.

Outlook

Several promising projects are underway in China. The technical committee has drafted a new mandatory minimum energy performance standard for refrigerators. The first draft of the standard has been submitted to SBTS, and should be officially issued in 1999, after which comments from stakeholders will be gathered and evaluated before the standard is signed into law. There is a 3 to 5 year review process required in the draft standard.

In 1989, the US Environmental Protection Agency and the National Environmental Protection Agency launched the "*US-China CFC-Free, Energy-Efficient Refrigerator Project"* to transform refrigerator production in China. Technology transfer is the principal component, and a prototype refrigerator which is 39 percent more efficient than comparable baselines, has been developed by Haier Group, a Chinese manufacturer. The project is now supported by the Global Environment Facility. Activities include labeling and standards components.[84] A consumer survey has been completed to inform the design of a consumer education campaign and purchasing incentives.[85]

The technical committee submitted a proposal to upgrade the air-conditioner standards to the SBTS this year. The SBTS included the standard revision in their workplan for 1998. The Worldwide Fund for Nature, the Beijing Energy Conservation Center, and Lawrence Berkeley National Laboratories are working with SBTS to provide training in international practices for setting energy performance standards.[86]

Lastly, the recently-passed National Energy Conservation Law requires standards be established sectorally (Article 14) and energy-consuming products be labeled (Article 26). Local authorities must draft regulations to implement the directive. This promises to ignite new standards and labeling activities.

[82] Xin, December 1997.
[83] Xin, November 1997.
[84] For more information, contact David Fridley and see proceedings of "Market Transformation. CFC-Free Energy-Efficient Refrigerator Project." Beijing, China 8-9, December 1997.
[85] Ogilvy and Mather.
[86] Judd.

Hong Kong

Summary

In 1995, the Hong Kong Government Electrical and Mechanical Services Department (EMSD) initiated a voluntary energy labeling program for refrigerators and added room air-conditioners (both window and mini-splits) in 1996. In December 1997, EMSD launched the program for clothes washers. The labeling program covers all new registered refrigeration appliances, room air-conditioners, and clothes washers imported to or manufactured in Hong Kong. The government is monitoring the labeling program, and will decide whether the labeling scheme should become mandatory, and whether to establish minimum energy efficiency standards. [87]

> ***Hong Kong's government recently launched a voluntary labeling program for clothes washers***

Energy Policy and Institutions

EMSD is developing the labeling program. The Energy Efficiency Advisory Committee was established in April 1991 to advise the government on energy-efficiency policy. In 1992, an Energy Efficiency Labeling Working Sub-Group was established under the Educational Campaign Working Group to consider how to develop a labeling scheme for Hong Kong. In July 1996, a new Energy Advisory Committee was formed to advise the government on a broad range of energy policy matters. An Energy Efficiency and Conservation Subcommittee was established under this new committee.[88]

Testing Facilities

The Consumer Council of Hong Kong, a quasi-governmental organization, performs energy efficiency testing. There are no accredited facilities in Hong Kong.[89]

Testing Procedures

The labeling scheme is based on ISO 8187 for refrigerators and freezers and ISO 5151:1994 for room coolers. For refrigerators, the ISO (8187) test used is the Subtropical class, designed for ambient indoor temperatures ranging between +18C and +38C. For room coolers, the ISO (5151 1994(E)) test conditions used are for a moderate climate: 27C dry bulb and 19C wet bulb for entering indoor air, and 35C dry bulb and 24C wet bulb for entering outdoor air.[90] For washers and washer-dryer, the reference test procedures are IEC and JIS.

Standards

There are no energy standards in Hong Kong.

Labeling

EMSD initiated the voluntary Energy Efficiency Labeling Scheme for refrigerators in June 1995, room air-conditioners in June 1996, and washing machines in December 1997. The air-conditioner labeling program covers window units and split systems that draw ten

[87] Chin.
[88] Chin, p 1.
[89] Nordicity, p 56.
[90] Chin, p 3.

kilowatts or less. The label rates the model on a scale of 1 to 5, one being the best, and relays annual energy consumption. The labeling program is completely voluntary. The label should be fixed on a prominent location and be easily visible. For refrigerators, the label is to be fixed on the top front door of every registered appliance.

Figure 21. Hong Kong Air-Conditioner Label

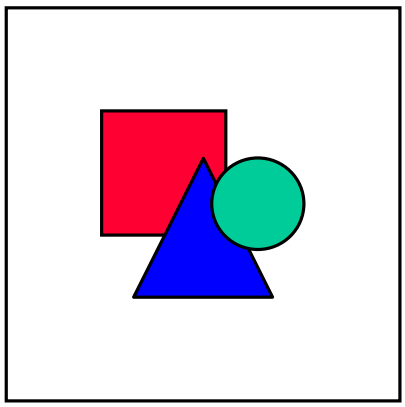


Figure 22. Hong Kong Refrigerator Label

Twenty-seven energy labels have been issued for refrigerators, freezers, and room air-conditioners.[91] Out of sixty refrigerator-freezer models only seven have applied for labels. There currently are no labels issued for washing machines.

Table 11. Status of the Hong Kong Voluntary Energy Efficiency Labeling Schemes[92]

	# Registered Models
Refrigerator-freezers	7
Room air-conditioners	20

Public promotion of the labeling programs has been an important activity. The types of media used include pamphlets, posters, seminars, television and radio announcements.[93]

[91] Li.
[92] Data as of 23 February 1998. Cheng, Brian.
[93] Li.

Woodward Clyde, an international environmental consulting firm, is researching the feasibility of establishing an eco-labeling program in Hong Kong. The analysis included tracing the trends toward eco-labeling worldwide, examining several schemes in depth, and conducting Life Cycle Analysis for two sample products. The project will 1) design a label that could be applied to energy efficient products; 2) consider the potential for and barriers to harmonizing eco-labels in Asia, and; 3) work with the government of Hong Kong to establish green procurement programs.[94] The Centre of Environmental Technology Limited is preparing a guidebook on international eco-labels for Hong Kong's export manufacturers.[95]

Monitoring and Enforcement

EMSD has set up a monitoring and enforcement scheme to make sure than manufacturers affixing the label are correctly reporting the energy performance of the models.[96]

Impact Data and Evaluation

There has been no evaluation of the impacts of the labeling schemes.

Outlook

Pending evaluation of the labeling scheme, the government will deliberate on whether to make the labeling program mandatory or establish energy performance standards.

[94] Camobreco; Thomson.
[95] Thompson.
[96] See Chin for a complete outline of monitoring and enforcement.

India

Summary

The Bureau of Indian Standards (BIS), a government agency, has established two energy efficiency standards—for refrigerators and air-conditioners; compliance is voluntary. These standards have been ineffectual in moving the market, especially in case of refrigerators (165 liter) at the current 2 kWh/day. At the proposed 1.25 kWh/day for 165-liter refrigerators, the standard would still be easily met by virtually all the models produced by the formal manufacturing sector. BIS is entertaining a proposal to establish a voluntary energy labeling program for refrigerators and air-conditioners.[97]

Energy Policy and Institutions

The Energy Management Centre (EMC) and BIS are the two key regulatory bodies which are responsible for setting higher standards and establishing standards for other equipment.

BIS, within the Ministry of Civil Supplies, is the legal authority for setting standards. The majority of its work concerns quality and safety standards rather than energy efficiency standards. The Tata Energy Research Institute (TERI) is an independent research organization that has worked closely with BIS and with manufacturers on refrigerator standards.

EMC is a cell under the Ministry of Power with a mandate to disseminate information, rather than develop and implement policy. EMC cannot function as a channel for finance, neither can it issue policy papers or energy efficiency labels. However, EMC has been active in efforts to strengthen and promote minimum efficiency standards for refrigerators and initiate energy labeling.

Testing Facilities

BIS has one laboratory which tests a wide range of products for safety and quality. It also tests refrigerators and compressors for energy efficiency. For legal reasons, BIS could not operate the energy efficiency testing facilities for a voluntary labeling scheme.

Laboratory facilities at the Indian Institute for Technology are capable of testing for the energy efficiency of refrigerators. The Consumer Education and Research Centre, a not-for-profit, aspires towards establishing energy efficiency testing capability.

Testing Procedures

Table 12. Indian Energy Efficiency Test Procedures

Tested product	Standard Code	Reference Standard
Refrigerators	IS: 1476-1979.	ISO
Room air-conditioners	IS 1391	ISO
Industrial motors	IS 4029	IEC

Standards

To date, the Indian government has established two voluntary energy efficiency standards. The standard for refrigerators has not succeeded in improving the energy efficiency of models

[97] Bhatia, August 1997.

on the market. Even after its revision from 2.0 kWh/day to 1.25 kWh/day for manual defrost 165 liter refrigerator, the standard will be easily met by virtually all the models produced by the formal manufacturing sector. Many of the room air-conditioners in India are produced by the informal sector, and may not meet the voluntary standard.

> ***India's refrigerator standard is easily met by virtually all the models produced by the formal manufacturing sector***

These standards have been set without economic or engineering analyses; decisions were mainly based on the recommendations of manufacturers.[98] A recent engineering and economic analysis on establishing minimum standards for refrigerators concludes, with preliminary data, that an optimal standard would be .65 kWh/ day.[99]

At a TERI/BIS workshop held on improving the efficiency of refrigerators in August 1996, participants proposed a standards level of 1.0 kWh/ day for 165 liter refrigerator.

Labeling

There is no energy efficiency labeling aside from BIS's metal plate certification which is affixed to the underside of a product. The plate is often painted over. The mark references the relevant product standard with which the model complies. Energy consumption is marked for motors, appliances, and lamps, and not presented effectively for informing and influencing consumer choice.[100]

In 1991, the government began "Ecomark", a voluntary ecolabeling scheme. Participation is limited to manufacturers who can test their own product. The energy consumption criteria is that the product be 5 percent more efficient than the BIS standard.[101]

At a January 1998 workshop organized by the Consumer Education and Research Centre and the United States Agency for International Development, stakeholders recommended that an energy labeling program be implemented by January 1999. The participants formulated recommendations on label type, program design, and products to be covered.[102]

Monitoring and Enforcement

There is a provision for regular inspection for monitoring compliance by any manufacturer that adopts the voluntary standard.[103]

Impact Data and Evaluation

There is no impact data available on the effects of the refrigerator standard, although the standard is widely believed to have been ineffective in improving efficiency of models on the market.[104]

Outlook

Standards-related momentum in India has recently intensified. Governmental, non-governmental and manufacturer organizations have initiated efforts to increase the current refrigerator standard, introduce other standards, and initiate energy labeling.

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[98] Sarkar.
[99] Bhatia, January 1998.
[100] Sarkar, p 6.
[101] Sarkar, p 7.
[102] "Consumer Acceptance of Energy Efficient Label Formats and Products Standards."
[103] Bhatia, February 1998.
[104] Bhatia, March 1997.

In March 1997, EMC convened a workshop on energy labeling to gather manufacturers' input on energy labeling programs. At a June BIS technical committee meeting, participants agreed to move forward with establishing energy labels for a variety of products.[105] Another workshop was held in Ahmedabad in January 1998 in which water heaters, refrigerators and air-conditioners were targeted for voluntary labeling.[106]

In addition, the Indian Electrical Equipment Manufacturers Association (IEEMA) and the Confederation of Indian Industries (CII) have expressed interest in developing a voluntary labeling program for motors.

[105] Bhatia, June 1997.
[106] Tribble.

Indonesia

Summary

There are currently no mandatory minimum efficiency standards or energy labels for any products in Indonesia. The government is now focused on erecting adequate air-conditioner and refrigerator testing facilities to support possible future standards and labeling programs. A 1996 study[107] developed a blueprint for an energy labeling program which could be used by the government. Despite the slow progress by the government, the private sector is ready to move forward on energy efficiency standards in order to prepare for the coming free trade area.[108] There have been delays in program development due to the recent currency crisis.

Energy Policy and Institutions[109]

The Energy Conservation Division within the Directorate General of Electricity and Energy Development (DGEED), established in 1984, set energy conservation targets to reduce energy consumption by 20 percent in the industrial sector, 25 percent in the residential sector, and 15 percent in the transportation sector by 1998.[110] The activities to achieve these targets are laid out in the 1995 Master Plan on Energy Conservation, drafted by DGEED. The Plan provides for incentives including import tax reduction on high-efficiency equipment, and soft loans to companies to implement energy-efficiency improvements. Aside from the Master Plan, one of the Division's five responsibilities is formulating regulations on equipment standards and labeling.

> ***The government is now focused on building testing facilities for air-conditioners and refrigerators***

In 1991, the state-owned utility, PLN (Perusaahan Listrik Negara), initiated a pilot demand-side management program.[111] The program remains limited, staffed by only a handful of people in the utility, and funded minimally. In this project, the utility installed 9-watt and 11-watt compact fluorescent lamps in about 600 residences in Jakarta, and electronic ballasts in two of PLN's Jakarta office buildings. In March 1995, PLN started a second, larger pilot project for its DSM program, which is being assisted by RCG/Hagler Bailly Co., a U.S.-based consulting firm, and is funded by the Asian Development Bank.

No energy efficiency building codes presently exist, but voluntary codes have been drafted. There are no plans to make the codes mandatory.

The Standardization Council of Indonesia (Dewan Standardisasi Nasional), established by the Presidential Decree in 1984, is the national body that coordinates, assimilates, and develops standards and meteorology. It is currently focused on quality assurance, but includes within its mandate the development and promulgation of testing procedures and energy performance standards for equipment. DSN ensures that a standard proposed by a technical institution (such as DGEED), goes through a process that secures a national consensus among the relevant government, business, scientific, and consumer groups. Once completed, this process results in an Indonesian National Standard (SNI). The process takes approximately two years to complete.

[107] IIEC, Bangkok 1996.
[108] IIEC, October 1996.
[109] For a more comprehensive look at Indonesia's energy policy, see IIEC, June 1997.
[110] Asian Development Bank.
[111] Opheim and du Pont.

Testing Facilities[112]

Indonesia currently has one laboratory at the University of Indonesia which conducts energy efficiency tests for refrigerators and refrigerator-freezers. This lab is not accredited.[113] The Indonesian government is in the process of trying to select an additional institution—either DGEED or PLN-- to house a laboratory which would test air-conditioners and possibly other equipment.[114] PLN currently has a laboratory which can calibrate, and measure the performance and safety of some equipment. The lab is accredited under ISO Guide 25. The lab is working at full-capacity just to test lighting equipment performance.[115]

The University's electrical laboratory has testing apparatus only for refrigerators, AC motors, generators, and switch gears for training. Though they have tested air-conditioners, the equipment is not appropriate.[116] At the university's Center for Energy Studies, staff have gathered data on all 145 liter refrigerators sold in Indonesia, however, the data is not publicly available yet. The Center is investigating the possibility of establishing a voluntary labeling scheme for refrigerators.[117] Under this scheme, the university would submit its data to DGEED, which would, in turn, publish labels.

Testing Procedures

See Table 13. for a listing of energy efficiency testing procedures used in Indonesia. Note that the University of Indonesia is moving towards adopting ISO procedures for refrigerators.[118]

Table 13. Indonesia's testing procedures

Product	Reference procedure
refrigerators	JIS C 9607[119]
air-conditioners	ISO[120]
lighting	IEC

Standards

There are currently no mandatory minimum efficiency standards for any products in Indonesia. The government is currently developing residential appliance efficiency standards and labeling programs. A major study was completed in 1996.[121] The study developed a blueprint for an energy labeling program for refrigerators and air-conditioners, which could be used by Indonesia's DGEED in the Ministry of Mines and Energy. DGEED is considering establishing energy performance standards for several types of equipment, including irons, refrigerators, air-conditioners, and lighting products.[122] This function falls within its existing duties which include developing regulations for equipment standards and labeling. PLN will be cooperating with the Ministry of Mines and Energy on the design of labeling programs.

Despite the slow progress on energy standards and labeling by the government, the private sector is ready to move forward on energy efficiency standards.[123] In fact, harmonization of

[112] IIEC, Bangkok 1996.
[113] Rinaldy.
[114] Blumberg.
[115] Soemarjanto.
[116] IIEC, Bangkok, 1996.
[117] Rinaldy.
[118] Indonesia is modifying its testing procedure towards ISO. Rinaldy.
[119] Moving to adopt ISO. Rinaldy.
[120] Indonesia hasn't yet started energy efficiency testing for air-conditioners, but it is planning to use ISO. Nordicity Group Ltd., Appendix B, p 4.
[121] IIEC, Bangkok, 1996.
[122] Soemarjanto.
[123] Ferreria.

standards and standards-setting activities would encounter very little opposition from firms, especially in light of their efforts to prepare for the coming free trade area.

Labeling

No energy labeling program exists.

Currently, there is one eco-labeling program in Indonesia, which has been developed by Badan Pengendalian Dampak Lingkungan (Bapedal), the Environmental Impact Management Agency. They have developed a green label for cars, which will become mandatory in 1998. The label will report whether an automobile complies with emissions standards.

Monitoring and Enforcement

As yet, there are no standards or labeling programs.

Impact Data and Evaluation

As yet, there are no standards or labeling programs.

Outlook

Indonesia's DGEED in the Ministry of Mines and Energy is considering establishing energy performance standards for several types of equipment, including irons, refrigerators, air-conditioners and lighting products.[124] The state-owned electric utility, PLN, will be cooperating with the Ministry of Mines and Energy on the design of labeling programs. Recently, the University of Indonesia submitted a proposal to DGEED to begin an energy labeling program for refrigerators and air-conditioners.[125]

[124] Soemarjanto.
[125] Rinaldy.

Japan

Summary

Japan's Energy Conservation Law of 1979 set efficiency standards for residential refrigerators and air-conditioners. In 1994, the government added standards for fluorescent lamps, televisions, heat pumps, and copiers.[126] Standards for refrigerators were omitted. The 1994 standards are not mandatory, and apply to each manufacturer's shipment-weighted average efficiency. Japan has labels for refrigerators and freezers.

Energy Policy and Institutions

The ministry which develops energy standards is the one with particular jurisdiction over a particular product. These institutions include the Ministry of International Trade and Industry (MITI), the Ministry of Construction, Ministry of Transport, etc.[127] The standards-setting process is quick—taking only one year—and does not involve a formal process of evaluating costs, but rather, standards are developed by an expert advisory committee.[128] The advisory committee is usually composed of academics who mediate between industry and government when defining the standard level.[129]

> ***The standards-setting process is quick—taking only one year—and does not involve a formal process of evaluating costs.***

Testing Facilities

Japan has four accredited laboratories.[130] Energy efficiency testing is conducted for refrigerators, refrigerator-freezers, freezers, room air-conditioners, mini-splits, single-package air-conditioners, industrial motors, fluorescent lamps and ballasts, clothes washers, microwaves, cooking heaters/ ranges, vacuums, water heaters, incandescent lamps and halogen lamps.[131]

Testing Procedures

Japanese Industrial Standards (JIS) procedures are used to test appliances and equipment. Since the use of JIS procedures can be considered a non-tariff trade barrier, Japan has conducted a comparative investigation of JIS and ISO test procedures for appliances and equipment. Refrigerator manufacturers now publish both JIS and ISO test results in their catalogues. It is likely that ISO procedures will be used increasingly in the future, not only just for refrigerators.[132] Table 14 lists the energy efficiency testing procedures used in Japan.

> ***Japan is in the process of switching from JIS testing procedures to ISO procedures.***

[126] Nakagami and Litt, p 1.
[127] Nakagami and Litt, p 4.
[128] Nakagami and Litt, p 1.
[129] Nakagami and Litt, p 5.
[130] Nordicity Group Ltd., p 56.
[131] Nordicity Group Ltd., p 90.
[132] Nakagami and Litt, p 12.

Table 14. Japanese Energy Efficiency Testing Procedures[133]

Product	Japanese Test Procedure	Reference Procedure
Heat pump air-conditioners	JIS B8616 and JIS C9612	ISO (at cooling mode)
Cooling-only air-conditioners	JIS B 8615-1984	ISO
Refrigerators	JIS B 8608 and ISO	ISO
Industrial Motors	JIS C4207 and JIS C4203	
Fluorescent lamps for general use	JIS C 7601	IEC
High-frequency point source fluorescent lamp	JEL 211	
Fluorescent lamps fixtures	JIS C 8105	
Clothes washer	JIS C 9806	
Clothes dryer	JIS S 2130	
Televisions	JIS-C6101	
Copiers (dry process indirect method electrostatic type)	JIS B0137 1025	

Standards

Japan's Energy Conservation Law of 1979 set target efficiency standards for residential refrigerators and cooling-only air-conditioners. In 1994, standards for fluorescent lamps, heat pump air-conditioners, televisions, computers, magnetic disk drives and copiers were added. These standards can neither be classified as mandatory or voluntary. There is no enforcement or penalties, however, the risk of public humiliation through a government announcement of manufacturer non-compliance has made non-compliance a moot issue.[134]

In the 1979 standards, the government targeted 1983 as the year by which the market would have attained the standard.[135] Three main criteria determined whether standards should be set for particular products. The product must 1) be widely used in daily life, 2) use a large share of energy, and 3) increase efficiency without unduly increasing the product cost. In 1984, refrigerators were removed from the Energy Conservation Law because efficiency targets were exceeded.[136]

The 1994 standards for other products apply to each manufacturer's shipment-weighted average efficiency and thus are not minimum energy performance standards. Standards are set at a level which can be attained with existing technology and at little cost.[137] Heat pumps were added because the saturation of heat-pump air-conditioners now exceeds that of air-conditioners that provide cooling-only. Virtually all models sold on the market are mini-splits.[138] The standards for heat pump air-conditioners were set with the goal that the standards be attainable by October 1997.[139] Notably, the government is requiring greater efficiency gains of those categories of air-conditioners with expected high sales growth.[140] Standards apply to about 93 percent of air-conditioners sold.[141]

Refrigerators were not included in the new 1994 standards because it was thought that the switch to non-CFC refrigerants would make it difficult to increase energy efficiency. Subsequently, the unit energy consumption of refrigerators increased, due to increases in average size and additional features. Thus, refrigerators are now being reconsidered for standards, since energy consumption has significantly increased since the 1980s.[142]

[133] Nakagami and Litt, pp 6-13.
[134] Nakagami and Litt, p 4.
[135] Nakagami and Litt, p 3.
[136] Nakagami and Litt, p 3.
[137] Nakagami and Litt, p 11.
[138] Rosenquist, 26 March 1997.
[139] Nakagami and Litt, p 9.
[140] Nakagami and Litt. p 9.
[141] Nakagami and Litt, p 9.
[142] Nakagami and Litt, p 5.

Table 15 through table 20 list target efficiency values for Japanese energy-consuming products.

Table 15. Japanese Target Efficiency Values for Combination Heating and Cooling Air-Conditioners[143]

Product Class	Min. Cooling COP	Min. Heating COP	Minimum $\frac{\text{Cooling COP} + \text{Heating COP}}{2}$	% improvement over 1992 baseline for average
Utilized cooling capacity ≤ 4 kW	2.19	2.38	2.33	5
Separate cooling capacity ≤ 4 kW	2.67	3.20	2.97	6
Cooling capacity 4 - 7.1 kW	2.34	2.56	2.50	5
Cooling capacity > 7.1 kW	2.45	2.62	2.59	5

Table 16. Japanese Target Efficiency Values for Cooling Air-Conditioners[144]

Product Class	Min. Cooling COP for October 1997	% improvement over 1992 baseline
Utilized cooling capacity ≤ 4 kW	2.45	10
Utilized cooling capacity 4 - 7.1 kW	2.20	8
Separate cooling capacity ≤ 4 kW	3.09	6
Separate cooling capacity 4 - 7.1 kW	2.42	11
Cooling capacity > 7.1 kW	2.45	5
Average for all categories	2.93	6

Table 17. Japanese Target Efficiency Values for Televisions[145]

Product Class	Max. Energy Consumption (kWh/yr)
Standard ≤ 21 inches	6.24S + 14.5 + A
Standard ≥ 22 inches	6.24S + 34.2 + B
Wide-screen	7.06S + 53.9 + B
HDTV	9.86S + 99.4

Japan has target efficiency values for fluorescent lamps that are to be met by the year 2000.

Table 18. Japanese Target Efficiency Values for Fluorescent Lamps[146]

Purpose of Lamp	Target Value (lumens/watt)
For Commercial and Public Lighting	75
For Residential Lighting	62

Japan has target efficiency values for copiers, computers and magnetic disk units that are to be met by the year 2000. The standards for copiers exclude color copiers and high-speed copiers, and various other specialty types of copiers. The standards cover about 90 percent of the copiers on the market.[147]

[143] Note: Effective 1998. COP = coefficient of performance. Test procedure is JIS-B8616. Source: Turiel, Kollar and McMahon, 1995 and Nakagami and Litt, p 9.
[144] Note: Effective 1998. COP = coefficient of performance. Test procedure JIS-C9612. Source: Turiel, Kollar and McMahon, 1995; and Nakagami and Litt, p 9.
[145] Note: Effective 1998. Based on 4.5 hours of operation and 19.5 hours of stand-by time per day. Excludes LED televisions. S = screen size in inches. Test procedure is JIS-C6101. A and B are:

	A	B
Built-in broadcast satellite reception	16.4	
Built-in video-deck	44.6	44.6
Built-in broadcast satellite reception and video-deck	61.0	
Other	0	0

[146] Note: Effective 2000. Test procedure is JIS-C8105.
[147] Nakagami and Litt, p 9.

Figure 23. Japanese Target Efficiency Values for Copiers[148]

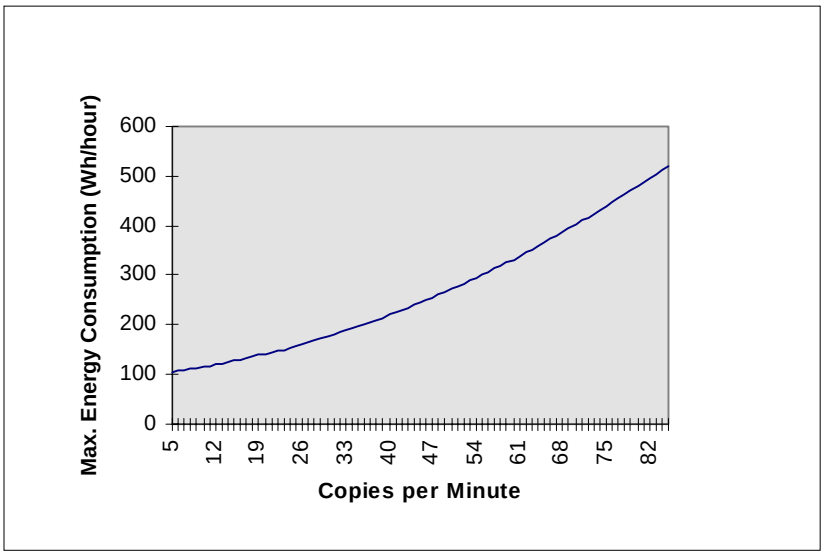


Table 19. Japanese Target Efficiency Values for Computers[149]

Computer Speed (CS)	Max. Energy Consumption (kW)
CS < 1	0.2
1 ≤ CS < 3	0.06
3 ≤ CS < 10	2.0
10 ≤ CS < 30	6.0
30 ≤ CS < 100	20.0
100 ≤ CS < 300	60.0
300 ≤ CS < 1,000	200.0
1,000 ≤ CS < 3,000	600.0

Table 20. Japanese Target Efficiency Values for Magnetic Disk Units

Type	Power Consumption (W) / Memory Capacity (Mbytes)
Single Magnetic Disk Drive	≤ 0.01
Disk Subsystem	≤ 0.03

Labeling

Energy labels exist for refrigerators and freezers. The label reports the model's size, energy consumption, as well as other information, and is affixed inside the door.[150]

MITI conducted a study of the possibility of implementing an energy labeling system and implementation may occur before the turn of the century.[151] As of spring 1998, the schedule is not yet publicly available.

[148] Note: Effective 2000. X = copier performance in copies per minute. Y = max. energy consumption in Wh/hour
[149] Note: Effective 2000. CS in million theoretical operations per second (MTOPS). These target values apply to the main computer unit, excluding display or printers. They do not apply to computers with operational performance greater than 3,000 MTOPS and computers employed for dedicated purposes (e.g. computers which specifically designed to be built into other machines or devices).
[150] Murakoshi.
[151] Nakagami and Litt, p 13

Monitoring and Enforcement

The Energy Conservation Law does not include any laws of enforcement, although certain actions are taken by MITI which act as incentives for compliance. If the manufacturer does not comply with the recommendation, further action will be taken, such as publicizing the matter or issuing an order to the manufacturer to meet the targets.[152]

Impact Data and Evaluation

The 1979 energy efficiency standards for air-conditioners and refrigerators resulted in efficiency improvements in the market. Energy consumption for refrigerators improved by 17 percent per year on average in 1984 since 1978.[153] Manufacturers made most of the efficiency improvements to their products before the standard target year of 1983, in anticipation of the standard.[154] In the mid-1980s, efficiency failed to further improve.[155]

The 1994 standards are mild, requiring no significant design or technology changes. Nonetheless, large efficiency improvements are expected because manufacturers will try to differentiate their products from competitors' through attaining high efficiency levels. For TVs, if 40 percent of the stock meets the new standards by the turn of the century, 3000 GWh will be saved in the year 2000.[156] For copiers, if 66 percent of the stock meet the standards, then 13 GWh will be saved and the average efficiency of copiers on the market will increase by 3 percent.[157]

Outlook

Japan is considering initiating labeling for a variety of products.[158]

[152] APEC Regional Energy Cooperation Working Group, JPN-11.
[153] APEC Regional Energy Cooperation Working Group, JPN-12.
[154] Nakagami and Litt, p 3.
[155] Nakagami and Litt, p 1.
[156] Nakagami and Litt, p 7.
[157] Nakagami and Litt, p 9.
[158] Turiel, p 9.

Republic of Korea

Summary

Korea launched a standards and labeling program in 1992, managed by the Korean Energy Management Corporation (KEMCO). The program established minimum efficiency standards for imported and domestically manufactured air-conditioners, lighting equipment and refrigerators; it mandates labeling. Over the past three years the energy efficiency of common appliances in Korea has dramatically increased. Korea has also established labeling programs for commercial and industrial equipment, including electric motors.

Energy Policy and Institutions

For several years, Korea has run one of Asia's most aggressive energy conservation programs. In fact, since the mid-1970s, there have been more than one hundred distinct conservation initiatives across all energy end-use sectors in the country. One of the most powerful programs has been Korea's mandatory standards and labeling programs.

> ***Korea has run one of Asia's most aggressive energy conservation programs.***

The Ministry of Trade, Industry, and Energy, as authorized by the Rationalization of Energy Utilization Act, sets energy efficiency standards levels, establishes effective dates, and specifies the energy use measurement.[159] The Ministry also sets the rules for labeling. KEMCO, a public agency, enforces these rules, supervises implementation, and monitors the programs. The energy-efficiency regulations carried out by KEMCO can be grouped into three components: Efficiency Standards, the Commercial Efficiency Labeling program, and the Efficiency Rating Labeling program for consumer goods.

Testing Facilities

Eight laboratories and research institutes provide testing services in support for the standards and labeling programs. Energy efficiency testing is conducted for refrigerators, refrigerator-freezers, freezers, room air-conditioners (single-package and mini-splits), industrial motors, fluorescent lamps and ballasts, heating cabinets, coffee pots, incandescent lamps, reflectors, and compact fluorescent lamps.[160] Upon testing the product, the testing laboratory provides the manufacturer or importer with an official efficiency level, which the manufacturer or importer then reports to KEMCO.

Korea's laboratories test refrigerators and freezers, air-conditioners, and lighting equipment. Three of them are:[161] the National Institute of Technology and Quality, Korea Institute of Energy Research, and Korea Academy of Industrial Technology.

Korean laboratories which test lighting equipment only include: Korea Inspection Center for Electric and Electronic Products, Electrical Engineering and Science Research Center, and Korea Electrotechnology Research Institute. Table 21 shows the energy-efficiency testing procedures used for the products which fall under Korea's standards and labeling programs.

[159] Ahn.
[160] Nordicity Group Ltd., pp 69-70.
[161] "Current Status of Energy Efficiency Standards and Labelling Program in the Republic of Korea" March 1997, prepared for the APEC Standards harmonization Steering Group Meeting, Vancouver, Canada.

Table 21. Korean Energy Efficiency Testing Procedures

Product	Korean Procedure	Reference Procedure
Air-conditioners	KS B 6368, KS B6369, and KS C 9306	JIS
Fluorescent lamp ballasts	KS C 8102-1981 & KS C 8100-1992	IEC
Fluorescent lamps	KS C 7601-1986	IEC
Incandescent lamps	KS C 7501-1986	IEC
Motors	KS 4004, KS 4202, KS 4005, KS 4204, KS 4002, KS 4205, KS 4210-13	IEC and IEEE[162]
Refrigerator-freezers	KS C 9305	JIS

Standards

The government began the Energy Efficiency Management System in Korea-- Standards and Labeling program in 1992. The Efficiency Standards Program sets efficiency levels for electric refrigerators, air-conditioners, lighting equipment (incandescent and fluorescent lamps; ballasts), and passenger cars. The labeling component of the program also covers commercial and industrial equipment. Key to the program has been its focus on manufacturers, retailers, and consumers to ensure that energy-efficient equipment is available and properly labeled.

Korea used a two-phase approach in introducing its standards, establishing a first set of minimum standards, and then ratcheting the standards up a few years later to a target level. Every three years, standards and labels are updated.[163] Korea derived the standards levels through statistical and engineering analysis through government-private sector negotiations.[164] Overall, standards and labeling were designed to reduce energy consumption by up to 7 percent by the end of 1993. "Target standards" were designed to reduce energy consumption by between 10 percent and 30 percent by the end of 1995.

Table 22 lists the Korean standards for refrigerators and refrigerator-freezers. The 1992 standards were designed to reduce energy consumption by 15 percent and 20 percent, respectively, from 1992 levels. In 1996, standards were upwardly revised and became effective January 1, 1997.

Table 22. Korean Efficiency Standards for Refrigerators and Refrigerator-Freezers[165]

Product Type	Size	Max. Energy Consumption (kWh/month) (1997)	Target 1998
Refrigerator	Any	.041AV + 20.82	.033AV + 16.86
Refrigerator-freezer	AV < 500 liters	.042AV + 37.79	.032AV + 28.79
	AV > 500 liters	.145AV - 14.15	.110AV - 10.74

Korea's efficiency standards for air-conditioners and heat pumps are designed to reduce energy consumption of single-package systems by 15 percent and split-systems by 20 percent, relative to 1991 levels. Table 23 and table 24 list the updated standards, effective January 1, 1997.

[162] Nordicity Group Ltd., p 47.
[163] Anonymous 1997.
[164] Turiel, p 9; Ahn.
[165] Anonymous 1997. Note: AV (adjusted volume) = refrigerator volume + (1.78 * freezer volume) @ ambient temperature of 30 degrees C, average refrigerator temperature of 3 degrees C and average freezer temperature of -18 degrees C.

Table 23. Korean Efficiency Standards for Constant Speed Air-Conditioners and Heat Pumps[166]

Product Type	Cooling capacity	Min. EER (kcal/h per Watt)	Target 1998
Window-type		2.2	2.5
Split-system	< 3,550 kcal/hour	2.5	2.7
Split-system	**9,000 > cooling capacity > 3,550 kcal/hour**	2.2	2.5

Table 24. Korean Efficiency Standards for Variable Speed Air-Conditioners and Heat Pumps[167]

Product Type	Cooling capacity	Min. SEER[168] (kcal/h per Watt)	Target 1998
Window-type		2.31	2.63
Split-system	< 3,550 kcal/hour	2.63	2.84
Split-system	**9,000 > cooling capacity > 3,550 kcal/hour**	2.31	2.63

Table 25. Korean Efficiency Standards for Fluorescent Lamps

Type	Watts	Lumens per Watt	
		Minimum (1994)	Target (1996)
Straight	20	60.0	72.0
Straight	40	70.0	85.0
Circular	30	53.0	68.0

Table 26. Korean Efficiency Standards for Fluorescent Lamp Ballasts[169]

Type	Watts	Min. Efficiency	
		Minimum (1995)	Target (1997)
Straight	20	0.92	1.15
Straight	40	0.97	1.18
Circular	30	0.97	1.15

Table 27. Korean Efficiency Standards for Incandescent Lamps

Voltage	Watts	Lumens per Watt	
		Minimum (1994)	Target (1996)
110	30	10.0	12.8
110	60	12.0	15.0
110	100	14.0	16.5
220	30	8.0	10.0
220	60	10.0	13.0
220	100	12.0	14.6

Labeling

Consumer goods are comparatively labeled. Refrigerators, air-conditioners, lighting equipment, and passenger cars. Models are rated on a scale from one to five, with the most efficient products being "one." All products' energy efficiency ratings must be mentioned in all product advertising. The energy-efficiency grade earned by a product is calculated by

[166] Anonymous 1997, p 5.
[167] Anonymous 1997, p 5.
[168] Seasonal Energy Efficiency Ratio (SEER) (kcal/hw) = cooling capacity (kcal/h) / power input, total watts (W).
[169] Note: Minimum efficiency is defined as the measured ballast efficiency compared to a reference ballast efficiency.

dividing the energy consumption of the product by the target energy consumption. The gradings for each product are listed in Table 28.

> ***Energy efficiency ratings must be mentioned in all product advertising.***

Table 28. Product Grading Scale[170]

Product Type	Size	1	2	3	4	5
Refrigerator & refr./fz	all	R≤ 1	1<R≤ 1.2	1.2<R≤ 1.4	1.4<R≤ 1.5	R>1.5
Constant-speed Window air-conditioners		2.5 < EER	2.3<EER≤2.5	2.1<EER≤2.3	2.0<EER≤2.1	EER≤2.0
Constant-speed split air-conditioners	cc < 3,550 kcal/hour	2.9<EER	2.7<EER≤2.9	2.5<EER≤2.7	2.3<EER≤2.5	EER≤2.3
Constant-speed split air-conditioners	9000>cc > 3,550 kcal/hour	2.6<EER	2.4<EER≤2.6	2.2<EER≤2.4	2.0<EER≤2.2	EER≤2.0
Variable-speed Window air-conditioner		2.63<EER	2.42<EER≤2.63	2.21<EER≤2.42	2.1<EER≤2.21	EER≤2.1
Variable-speed Split air-conditioners	cc< 3,550 kcal/hour	3.0<EER	2.84<EER≤3.0	2.63<EER≤2.84	2.42<EER≤2.63	EER≤2.42
Variable-speed split air-conditioners	9000>cc > 3,550 kcal/hour	2.73<EER	2.52<EER≤2.73	2.31<EER≤2.52	2.1<EER≤2.31	EER≤2.1
Fluorescent lamps	all	R≤ 1	1<R≤ 1.1	1.1<R≤ 1.2	1.2<R≤ 1.3	R>1.3
Ballasts	all	R≤ 1.18	1.18<R≤ 1.09	1.09<R≤ 1.0	1.0<R≤ .97	R>.97
Incandescent	all	R≤ 1	1<R≤ 1.1	1.1<R≤ 1.2	1.2<R≤ 1.3	R>1.3

Energy labels showing energy-efficiency levels are required for many kinds of commercial equipment including steel boilers, cast iron boilers, oil heaters, hot water boilers (coal-, oil-, liquid petroleum gas-, and liquid natural gas-fired), and instantaneous water heaters. These products are classified as "efficiency-indicated equipment." Importers of foreign products and domestic manufacturers are required to submit designated products for testing by authorized agencies. Unlike the consumer goods comparative labels, the labels for commercial equipment do not provide information on the relative energy efficiency of a particular product compared with others in its class. However, the information relating test results does allow consumers to compare products. A product's energy efficiency also must be explicitly stated in almost all product advertising.

[170] The Rating Factor, [R], for refrigerators is the energy consumption per month / target energy consumption. The [R] for incandescent and fluorescent lamps is the target energy efficiency (1 m/ W) / energy efficiency (1m/ W) of the lamp. The [R] for ballasts is the ballast efficiency/ target efficiency. Anonymous 1997.

Figure 24. Korea Refrigerator Energy Label.

Figure 25. Korea Air-Conditioner Energy Label

The government also operates an endorsement labeling program for high-efficiency motors that was introduced in late 1992. Korean standard KS C 4202 specifies the high-efficiency standards for 3-phase 4-pole (1,800 rpm) induction motors with a power rating of less than 37 kW (50 hp). Manufacturers that meet this requirement are eligible to put the Korean high efficiency label on their motor at the point of sale.

Table 29. Products Covered by Energy Labeling Rules in Korea

Labels Must Indicate Absolute Energy Efficiency	Labels Must Indicate Relative Energy Efficiency
Steel, cast iron and water boilers	Refrigerators
Oil heaters	Air-conditioners
Instantaneous water heaters	Incandescent and fluorescent lamps
Lighting equipment	Fluorescent lamp ballasts
Automobiles	Automobiles
Electric Motors (endorsement)	

Monitoring and Enforcement

KEMCO conducts regular monitoring of efficiency claims. The agency randomly inspects factory or marketplace, taking samples up to three times a year. KEMCO verifies that all

products covered by the law are labeled and that labels accurately reflect the product's energy usage.

Impact Data and Evaluation

The standards and labeling program has achieved remarkable results in a short time as can be seen in Table 30. Over the past three years the energy efficiency of common appliances in Korea has dramatically increased. By late 1993, the 1993 minimum efficiency levels had been reached by 91 percent of domestic products, and the 1995 target levels had been reached by 30 percent of products.[171] Refrigerators' energy consumption has dropped by 11 percent, while air-conditioners' consumption levels have dropped by an average of 24 percent.[172] KEMCO studies also found that sales of energy-efficient equipment rose in proportion to sales of standard equipment because of the program.

> ***By late 1993, the 1993 minimum efficiency levels had been reached by 91% of domestic products, and the 1995 target levels had been reached by 30% of products.***

Table 30. Energy-Efficiency Improvements of Selected Products, Korea[173]

Products	Units	1992 Standard	September 1993 Efficiency	Improvement	National Energy Reduction
Refrigerators	kWh/month	45	40	11.1%	1.8%
Air-conditioners	kcal/Wh	2.14	2.65	23.6%	0.2%
Incandescent Lamps	lm/W	10.6	11.9	12.3%	0.8%
Fluorescent Lamps	lm/W	65.3	69.4	6.3%	0.7%
Passenger Cars	km/l	13.9	14.0	0.9%	0.6%

Based on data from an early stage of the labeling program, the market share of efficient equipment has increased due to the labeling program: the percentage of products in the highest grade (number1) increased from 10 percent to 17 percent.[174]

Outlook

The government is currently considering establishing labeling programs for clothes washers, microwave ovens, electric rice cookers, televisions, vending machines, compact fluorescent lamps, electric radiant heaters, and electric water heaters.[175] Labels may be updated for the consumer goods in 1999.

[171] APEC 1994.
[172] Rumsey and Flanigan, September 1995(a).
[173] Rumsey and Flanigan. September 1995(a), p 18.
[174] APEC 1994.
[175] Anonymous 1997; Ahn.

Malaysia

Summary

The Ministry of Energy, Telecommunications and Posts issued efficiency standards for motors in 1989. There are no other standards, labeling, or energy testing programs to date. However, draft energy efficiency regulations which have not yet been publicly released include mandates for establishing minimum energy performance standards for ballasts, fans, room air-conditioners, irons, water storage heaters, and refrigerators.[176]

Energy Policy and Institutions

The Ministry of Energy, Telecommunications and Posts (METP) is responsible for the implementation of energy efficiency policies in Malaysia. The METP oversees energy policy formulation and any energy efficiency activities. The regulatory framework lacks laws covering energy efficiency. The Department of Energy Supply, housed within the METP, is preparing regulations to promote DSM. This Energy Efficiency Regulation will: 1) mandate the hiring of several energy efficiency officer, although their designated duties seem weak; 2) issue requirements for energy consuming equipment; and 3) schedule the labeling of energy-consuming products.[177] The regulations were drafted in 1996 and have yet to be adopted.

> ***Few energy efficiency activities are being pursued in Malaysia, despite the large potential for savings.***

Tenaga Nasional Berhad (TNB), a major electric utility in Malaysia, has initiated promotion of energy-efficient equipment and formed a DSM unit in September 1993. What little DSM there is focuses on peak shaving. Few other DSM activities are being pursued, despite the large potential for DSM savings. Malaysia has surplus capacity and currently exports energy resources. Overall, neither Tenaga Nasional Berhad nor the Malaysian government has been very supportive of DSM efforts in the past.

Testing Facilities

The Standards and Industrial Research Institute of Malaysia (SIRIM) Berhad, a wholly owned company of the Malaysian Government, provides electrotechnical testing services to the industry and consumers in Malaysia for safety and performance of numerous electric equipment and devices. These test laboratories do not perform efficiency tests.

Testing Procedures

The existing test laboratories focus only on safety and quality requirements. No set procedures for efficiency tests exist.

Standards

In 1989, the METP issued efficiency standards for motors in Malaysia. Table 31 lists these standards.

[176] Chong Cheong.
[177] Jaafar.

Table 31. Malaysian Efficiency Standards for Motors[178]

Size (kW)	Min. Rated Efficiency (percent)
0.4	72
0.8	78
4	83
8	85
40	90
80	91.5
100	92

Labeling

Malaysia does not have an energy labeling program. SIRIM plans to establish and energy labeling unit. It is currently responsible for ensuring compliance to established local safety standards and providing a safety stamp.

Impact Data and Evaluation

There is no impact data available from the motors standards.

Outlook

The Department of Electricity and Gas Supply is working with SIRIM to develop energy efficiency standards and design a complementary labeling program. The list of products to be covered has not been finalized, but it is likely the program will cover air-conditioners, refrigerators, fans, and ballasts. Other items, such as irons, rice cookers, and electric storage water heaters are also being considered.

[178] Kannan.

Philippines

Summary

The Department of Energy, Bureau of Product Standards and the Association of Home Appliance Manufacturers set minimum efficiency standards and require energy labeling for air-conditioners. The program was launched in 1993. The government is now introducing energy labeling for refrigerators. There are also plans to expand the program to cover ballasts, industrial motors and washing machines before the year 2000. The program, a highly successful model, demonstrates how government, lacking utility involvement, can accelerate market transformation at low cost in collaboration with manufacturers. The program has the potential to become a powerful platform for subsequent energy efficiency efforts not only in the Philippines but also in other Asian countries.[179]

Energy Policy and Institutions

After Thailand, the Philippines has the most developed DSM program in the region. An Integrated Resource Planning (IRP) study has been completed and an efficiency-friendly regulatory and institutional framework exists, although IRP has not yet been adopted since it is couched in a stalled omnibus bill. The Philippines utilities (Napocor, Cepalco, and Meralco), are all developing DSM implementation plans.

The Philippines Department of Energy (DOE) manages most aspects of energy policy and planning in the Philippines, and chairs the DSM Working Group for the nation. The Energy Regulatory Board is responsible for formulating and implementing DSM program.

> ***One of the Department of Energy's greatest accomplishments is the Residential Air-Conditioners Standards and Labeling program.***

One of the Philippine DOE's greatest accomplishments in terms of energy efficiency is the Residential Air-Conditioners Standards and Labeling program. After years of coordination with manufacturers and the Department of Trade and Industry's Bureau of Product Standards (BPS), DOE launched the program in late 1993, and began labeling in early 1994.

The so-called AirCon program is jointly administered by the DOE, the Department of Trade and Industry, and the Association of Home Appliance Manufacturers. The three parties signed a memorandum of agreement in July 1992. The Department of

Trade and Industry's BPS is the Philippines' national standards body mandated to develop, implement and coordinate standardization activities in the Philippines. BPS enforces the standards. DOE administers the program and runs the Fuels and Appliance Testing Laboratory (FATL). FATL is a key component of the program, serving as a neutral testing laboratory to verify manufacturers' assertions of the efficiency of their units.

The DOE establishes the guideline for establishing standards and labels, and FATL establishes the implementing guidelines. Standards formulation are initiated by government agencies or industry/trade groups to address product safety or performance. Standards are developed by Technical Committees constituted by representatives from all sectors of society including government agencies, suppliers, manufacturers, consumers, and members of the academe. The DOE, BPS and AHAM are committed to develop and implement a public information campaign.

[179] Peter and Flanigan, September 1995(b).

Testing Facilities

FATL's laboratory tests single-package and split system room air-conditioners and, on manufacturer request, split system air-conditioners. Testing is also conducted for fluorescent lamps, ballasts, and fans for energy efficiency. FATL recently built a testing room for refrigerators, refrigerator-freezers, and freezers.[180]

FATL is capable of testing window type room air-conditioners and split systems with cooling capacity of 30,000 kilojoules per hour and below. It takes one day to test one room air-conditioner and three days to test a refrigerator. Their facility can accommodate one air-conditioner per test run, and four refrigerators per run.

The annual operating cost of FATL is about US$160,000 to $200,000 and the initial construction of the laboratory cost US$675,000. For consumers, the average price of an air-conditioning unit increased US$30, about 5 percent of a unit's total cost, due to the program.[181]

Testing Procedures

Table 32. Philippines testing procedures

Product	Philippines procedure	Reference procedure
refrigerators	PNS 396-2: 1997	ISO
air-conditioners	PNS 396-1:1995	ISO[182]
lighting	IEC	IEC

The Philippines has a policy of aligning its testing procedures with ISO/IEC.[183]

Standards

Single-package room air-conditioners, both imported and domestically manufactured, are required to meet a minimum efficiency standard and required to be labeled. Air-conditioners are given priority because, while only penetrating a small fraction of households, they represented one of the most dramatic areas of increased demand for electricity in the residential sector. The Energy Efficiency Ratio (EER), measures the efficiency of air-conditioners based on output cooling capacity and energy consumption. The minimum standards established through the program set a ground EER for all air-conditioning systems. The EER also serves a labeling function.

To date, the Bureau of Product Standards (BPS) has issued one efficiency standard, for room air-conditioners, called PNS 396-1:1995 "Household Appliances—Standard for Energy Efficiency Ratio & Labeling Requirement." Table 33 describes this standard.

Table 33. Philippine EER for Room Air-Conditioners (1997-2002)[184]

Size	1997	1998	1999	2000	2001	2002
< 12,000 kJ/h	8.3	8.7	8.7	8.7	9.1	9.1
12,000 to 26,000 kJ/h	7.8	7.8	8.2	8.2	8.2	8.6

In 1997, the standard was tightened so that the EER increases 5 percent every three years until 2002.[185] It is noteworthy that most manufacturers are producing air-conditioner models with

[180] Nordicity Group Ltd., p 69.
[181] Rumsey and Flanigan, September 1995(b), pp 20-1.
[182] The Philippine test condition deviates from the ISO 5151 condition outdoor temperature = 27ºC wet bulb The Philippines switched away from the AHAM standard to hasten the country's accession to the World Trade Organization.
[183] Hernandez.
[184] Philippine National Standard 396-1: 1995.

much higher EERs than the standard requires—most range between 9.0 and 11.0.[186] In early 1998, split air-conditioners were required to meet the EER.

It took more than ten years to set up the Residential AirCon program. The major government changes in the mid-1980s, and the resulting economic downturn delayed the start-up. Also delaying the process were the painstaking (though ultimately rewarding) private sector negotiations to develop reasonable standards that could be improved over time. The private sector has been a key driver behind the air-conditioner program.

> ***Most manufacturers are producing air-conditioner models with much higher efficiencies than required by the standard.***

The standard was determined through a consensus process which closely involved the manufacturers. Factors considered were how costly improving compressors would be, what the average EER of air-conditioners on the world market was, and what the benchmark efficiency would be for local manufacturers to effectively compete with imports.[187]

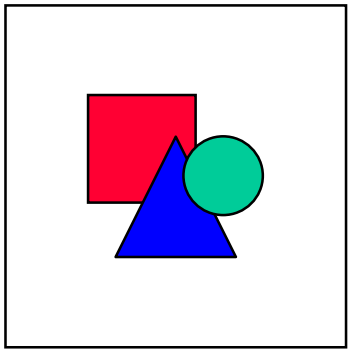
Labeling

Energy labels are issued only for single-package room air-conditioners. The label design is detailed information. The air-conditioner label was designed by the engineers at FATL, and then approved by the Technical Committee. No marketing consultations took place.

In early 1998, FATL launched a refrigerator program similar to the labeling portion of the Aircon program. In the case of refrigerators, the government initially proposed to make the program voluntary, but manufacturers, anxious to play on a level field, pressed for a mandatory program. In February 1998, DOE signed a Memorandum of Agreement with DTI and AHAM to begin a mandatory labeling program for refrigerator/ freezers. FATL will test all available refrigerator models on the market, numbering over 200, and believes this task will be completed by November 1998. By July 1999, all models will be labeled, and those that are not will not be allowed to be sold. The label that will be used is modeled on the US label, and will be similar to the air-conditioner label now used in the Philippines.[188]

[185] Zabala.
[186] FATL 1997.
[187] Hernandez.
[188] FATL 1998.

Figure 26. Philippine Air-Conditioner Energy Label



Monitoring and Enforcement

The Department of Trade and Industry reported that field monitoring revealed that there is 97 percent compliance with the energy labeling requirements for air-conditioners during 1997.[189]

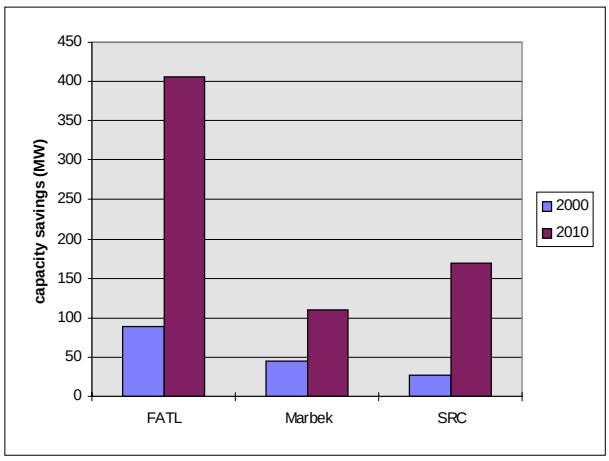
Impact Data and Evaluation

Before the initiation of the program, only half of the annual sales volume for small-sized, window-type air-conditioners met the standard and none of the larger units did. By forcing these units off the market, the program had an immediate and pronounced effect in the overall efficiency of air-conditioners on the market. When the standards were made more stringent in 1996, the least efficient units were again eliminated. Due to the "push" of standards and the "pull" of labeling, FATL analysis suggests that there was a 23 percent improvement in energy consumption of all air-conditioning units between 1992 and 1997.[190]

> ***The energy consumption of air-conditioners fell 23% between 1992 and 1997***

Estimates of the program are preliminary at best, but it appears that the standards component of the program resulted in first-year capacity savings of 6 MW of capacity and energy savings of over 17 GWh. The estimates, though rough, are conservative because they do not incorporate efficiency improvements in split systems or from the labeling component of the program. The impact of the program will increase with time because the number of air-conditioners in the country is rising dramatically. Manufacturers conservatively estimate that the market will grow by 20 percent annually for the future. In 1994, demand for window-type units increased by nearly 40 percent.

Figure 27. Projected Savings of Philippines AirCon Program



Based on this demand growth, by the year 2010, program analysts believe the

[189] Memo from Dr. Elauria to Ms. Norma Hernandez, 2 February 1998.
[190] Campañano.

program will have saved anywhere from 83 MW to 400 MW of peak capacity and will have resulted in cumulative energy savings of 322 to 1,120 GWh. Figure 27 depicts the projected savings calculated in three different analyses.

An unanticipated benefit has been that Philippine air-conditioners have begun to sell better in export markets due to their high efficiencies.[191]

Outlook

Early this year, the Committee devised an aggressive schedule for expanding program activities to refrigerators, ballasts, industrial motors and washing machines before 2000. The refrigerator labeling program already began in February. The Committee also ratcheted upwards the energy-efficiency ratio requirement for air-conditioners and extended it to split-type models.

FATL's timetable for introducing energy labeling for the products is detailed in Table 34.

Table 34. Schedule for Energy Standards and Labeling in the Philippines[192]

Year	Product	Type of Program
1998	Refrigerators, freezers	Labeling
1998	Ballasts	Standards and labeling
1999	Washing machines	Labeling
2000	Industrial motors	Voluntary program

The Philippines' utilities are all developing DSM implementation plans. The DOE is responsible for formulating and implementing DSM programs and chairs the DSM Working Group for the nation. To date, standards and labeling have not been incorporated into DSM programs.

[191] Hernandez.
[192] Draft schedules, February 13 1998.

Singapore

Summary

Singapore's Trade Development Board established an energy efficiency standard for room air-conditioners, however none of the accredited laboratories conduct energy efficiency testing. There also are no enforcement or verification mechanisms because there is no need: all models easily meet the standard.[193] There are no energy labels for any appliances.

Energy Policy and Institutions

Most legislation related to energy conservation is in the form of guidelines only.

> ***If Singapore's building code had built a process of revision into the law, the code would have been more effective.***

Except for buildings, Singapore has no energy conservation laws, no compulsory standards, and no labeling schemes. The building code, established in 1979, requires minimum Overall Thermal Transference Value (OTTV). Besides the mandatory OTTV requirement, the building regulations include a set of prescribed conditions for air-conditioned space and lighting load density. Other building standards include lighting levels in buildings, lighting load design, and maintenance of air-conditioning equipment.[194] The code is generally not considered to be very strict, but is now being overhauled for the first time since its creation nearly two decades ago. If the code had built-in a ratcheting requirement, then the process of revising the standard would not have been so difficult.

The Ministry of Environment passed a Green Plan last year which offers tax grants to purchasers of efficient equipment. The legislation is poorly crafted and is unlikely to boost production or consumption of high-efficiency products.

Testing Facilities

There is no energy efficiency testing done on appliances through the government-run laboratory, the Productivity and Standards Board (PSB). Testing focuses on safety and performance. Standards are drawn mostly from IEC for electric products, although Singapore uses other standards from Japan, United States and Europe.[195]

There are eighty accredited labs in Singapore, but none of them perform tests for energy efficiency. Labs are not required to be accredited, and it is possible some of these unaccredited labs might perform energy-efficiency testing.[196] Sanyo, Daiken, Carrier, National, and Panasonic are some appliance manufacturers based in Singapore which may have energy efficiency testing capability.

PSB's Electronics Test Centre is measuring the energy performance of computers and conducting tests for the Green Labelling Scheme.[197]

[193] Rashid.
[194] APEC 1994.
[195] Most of the material in this section is drawn from IIEC, November 1992 Annex D.
[196] Lam.
[197] Nordicity Group Ltd., p 8.

Testing Procedures

No energy performance testing takes place.

Standards

There is one energy efficiency standard for room air-conditioners. Room air-conditioners are required to meet an EER of 8.0 for models 9,000 BTU and above. This does not apply to split systems. The Trade Development Board is responsible for the implementation of the EER requirement.

Labeling

There are no labeling programs for any appliances or electric equipment. The Ministry of Environment is initiating a green labeling program. The program covers at least compact fluorescent lamps and washing machines. Energy consumption is only one criterion for obtaining the label.

Monitoring and Enforcement

There are no enforcement or verification mechanisms because most manufacturers meet the standard.[198]

Impact Data and Evaluation

There is no data on the impact of the air-conditioner standard.

Outlook

The government of Singapore has pursued few energy efficiency policies, aside from the building code. There are no known plans for introducing energy efficiency standards or energy labels.

[198] Rashid.

Taipei China (Taiwan)

Summary

The Energy Commission in the Ministry of Economic Affairs developed minimum efficiency standards for a variety of products: window and central air-conditioners, fans, water heaters, clothes dryers, ovens, stoves & ranges, fishing boat engines, range hoods, ballasts, refrigerators, and electric motors. In 1992, the program had reduced peak power demand by an estimated 341 MW. The government has also recently launched an energy labeling program for window-type air-conditioners, refrigerators, and washers.[199]

> ***Taipei China's program reduced peak power demand by approximately 341 MW***

Energy Policy and Institutions

The program of mandatory energy-efficiency standards is implemented by the Bureau of Commodity Inspection and Quarantine, the Energy Commission, and the Ministry of Economic Affairs.[200]

Testing Facilities

Over 100 public and private laboratories conduct energy efficiency testing in Taipei China, but it is unknown how many of these are accredited.[201]

Testing Procedures

Information on test procedures was not available for this study.

Standards

Energy efficiency standards exist for window and central air-conditioners, fans, water heaters, clothes dryers, ovens, stoves and ranges, fishing boat engines, range hoods, ballasts, refrigerators, and electric motors. Standards are not all mandatory.[202]

Table 35. EER Standards for Air-Conditioners in Taipei China (1996)[203]

	Window-type	Package type	Central
EER	7.75	9.82	15.00

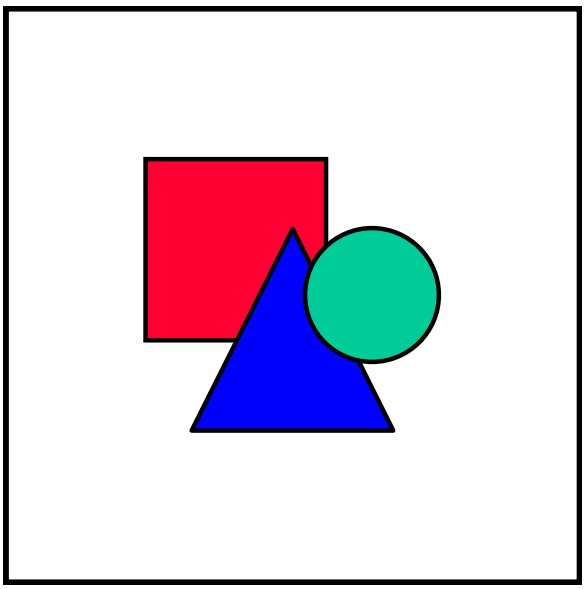
The efficiency standards for air-conditioners were set in 1980. The standard increases about 5 percent per year.

Labeling

The government has also recently launched an energy labeling program for window-type air-conditioners refrigerators, and washers, although the program is not yet enforced.[204] There is also an environmental labeling program.

[199] Yang, p 10.
[200] APEC Committee on Trade and Investment, p 9.
[201] Nordicity Group Ltd., p 56.
[202] Tsau.
[203] Yang, p 10.
[204] Yang, p 10.

Figure 28. Taipei China's Ecolabel.



Monitoring and Enforcement

Manufacturers can test their own products or send them to a designated laboratory. Random checks on product performance are conducted by the government.[205]

Impact Data and Evaluation

In 1992, the program was expected to have reduced peak demand by 341 MW and saved 9.6 x 10^{17} liters of oil.

Outlook

It is likely that more standards and regulations will be issued in response to the Conference of the Parties 3, held in Kyoto, Japan in 1997.[206]

[205] Tsau.
[206] Tsau.

Thailand

Summary

Thailand has energy-efficiency labeling programs for refrigerators and for air-conditioners. Both programs are entirely voluntary and are not associated with minimum energy efficiency standards. The government and fluorescent lamp manufacturers reached a voluntary agreement to switch from 40 W lamps to 36 watt lamps. No minimum efficiency standards have been set to date, but the Thai government is in the process of establishing them for ballasts, air-conditioners, refrigerators, and industrial motors. The national utility also operates a voluntary endorsement labeling program for high-efficiency motors.

Energy Policy and Institutions[207]

The Electricity Generating Authority of Thailand (EGAT) and the Thai government not only have constructed a policy framework which breaks down market barriers to energy-efficient goods and services, but have also placed significant financial resources behind their programs. The result is one of the most comprehensive energy efficiency programs in Asia. This framework has lent high-level credence to EGAT's voluntary programs.

Thailand boasts one of Asia's most successful and comprehensive energy efficiency programs. In 1992, with IIEC assistance, Thailand drafted and approved a five-year US$189 million national DSM plan. EGAT began implementing the plan in late 1993. The 1992, the Thai government passed an Energy Conservation Promotion Act which mandates energy-efficiency activities over and above those of the DSM plan and requires large facilities to meet energy-efficiency targets. It also promotes rural and renewable energy, research and development, and cogeneration projects. The Act created an Energy Conservation Promotion Fund, financed by a levy on petroleum products to provide a financing mechanism. The fund is one of the largest energy conservation funds in the world, and is overseen by the National Energy Policy Office (NEPO). The fund retains US$400 million, with annual estimated inflows of US$60-80 million.[208]

> ***The Energy Conservation Promotion Fund is financed by a levy on petroleum products.***

The Energy Conservation Promotion Act provides a legal framework for energy-efficiency program implementation. In particular, Section 23 of the law provides the government with the legal foundation to set energy-efficiency standards and labels for energy-consuming products. Although the Department of Energy Development and Promotion has the authority to issue minimum efficiency standards for appliances, it has not done so.

EGAT's DSM program—which includes the labeling programs as well as technology demonstrations, manufacturer voluntary agreements, and time-of-day tariffs-- is the largest in Southeast Asia. EGAT administers the voluntary labeling programs through its DSM Office.

Aside from EGAT, other government institutions involved in setting up standards and labeling programs include: the National Energy Policy Office (NEPO), the Thailand Industrial Standards Institute (TISI), the Department of Energy Development and Promotion (DEDP), and the Office of Consumer Protection (OCP) .

[207] This section excerpted from Egan, UN-ESCAP.
[208] Egan, November 1996-February 1997.

- NEPO, the energy ministry which is under the Prime Minister's Office, has the mandate to design Thailand's national energy policy. NEPO has the authority to issue energy efficiency standards.
- TISI is the national standards organization for Thailand, and is governed by the Industrial Product Standards Council. TISI's mandate includes preparing and publishing national standards, promoting the implementation of the standards, and representing Thailand in the International Standards Organization. TISI is responsible for testing the energy performance of air-conditioners and refrigerators under EGAT's voluntary labeling program.
- OCP is responsible for legal processing of labeling that has been requested by government agencies. Normally, this labeling is backed by legislation that can charge those who misrepresent their products with illegal misconduct under the law. OCP does not develop specifications for labeling, but rather works with a sponsoring agency which is responsible for developing labels. OCP shares power with TISI to enforce standards, and is empowered to make labels mandatory. OCP can take products off the market if proven that the products do not meet the quality standards defined according to the label.
- DEDP is an agency responsible for implementing the policies designed by the National Energy Policy Council. DEDP, like NEPO, has the legal authority to develop energy-efficiency standards and labels.

Testing Facilities

In Thailand, energy efficiency testing is conducted for refrigerators, mini-split air-conditioners, fluorescent lamps and ballasts. Testing for EGAT's voluntary labeling programs for refrigerators and air-conditioners is done at TISI. Three accredited testing facilities can test air-conditioners. They are Industrial Standardization Testing and Training Center of TISI, Chulalongkorn University, and Kasetsart University.

TISI's facility is the highest quality air-conditioner testing facility. Chulalongkorn's testing facility is believed to be less accurate, but it was recently upgraded. Kasetsart's facility is the least accurate. When evaluated in 1992, it was not recommended to rate air-conditioner efficiency for industry, due to the high probability of significant error because of poor instrumentation and techniques.[209]

TISI is the only laboratory suitable for testing refrigerators.

[209] IIEC, November 1992, Annex D.

Testing Procedures

Table 36. Thai Testing Procedures[210]

Product Type	TISI Standard	Reference Standard
Air-conditioners		
a. Window Type	TIS-385-1981	ISO
b. Split System	TIS-315	JIS
Refrigerators	TIS-2637-1994	ISO
Ballasts	TIS-23-1978	IEC
Motors		
a. 1-phase	TIS-866-1989	IEC
b. 3-phase	TIS-867-1989	IEC

Standards

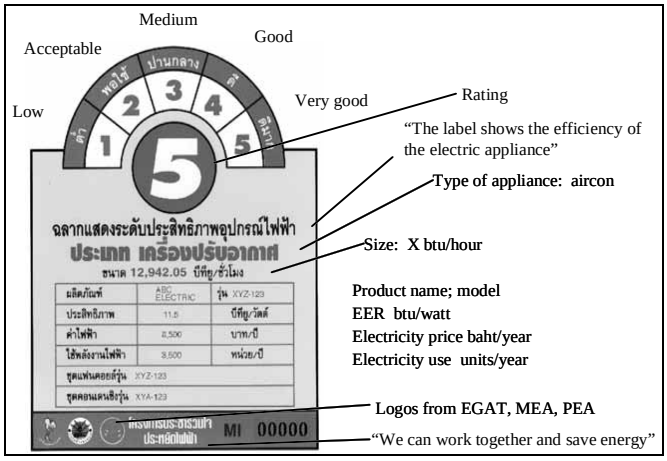
No energy efficiency standards exist.

Labeling

EGAT established voluntary labeling programs for the two largest energy-consuming appliances in the residential sector-- refrigerators and air-conditioners in 1995 and 1996 respectively.

In early 1994, EGAT gained the cooperation of the five Thai refrigerator manufacturers for a voluntary testing and labeling program for the largest category of one-door Thai refrigerators (5-6 cubic feet). A similar 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 industry consists of fifty-five manufacturers, many of which are small, local assembly operations.

Figure 29. Thailand's Air Conditioner Energy Label



The efficiency scale on the label for each program is 1 to 5, with 5 being the most efficient. A selection of the refrigerator models were tested during the fall of 1994 to establish the mean energy consumption. Models that fell within 10 percent of the average are rated at 3; models that are from 10 percent to 25 percent more efficient than the average are rated at 4; and models that are more than 25 percent more efficient than the average are rated at 5. The gradings for air-conditioners are listed in Table 37.

[210] IIEC, November 1992, Annex D; and Nordicity Group Ltd., p 29.

Table 37. Air-Conditioner Gradings for Labeling, Thailand[211]

Grading	Definition
1	EER < 7.6
2	7.6 <EER < 8.6
3	8.6 <EER < 9.6
4	9.6 <EER < 10.6
5	10.6 <EER

In 1996, EGAT launched a high-efficiency motors (HEM) program to reduce demand by 40 MW and save 265 GWh of energy in the industrial sector by the end of 1998.[212] The program offers interest-free loans for three years at US$440 per kW saved.[213] To date, four industrial motor users have joined the program, but only two have replaced old motors with HEMs.[214] EGAT has also initiated a complementary voluntary green labeling program for industrial motors.

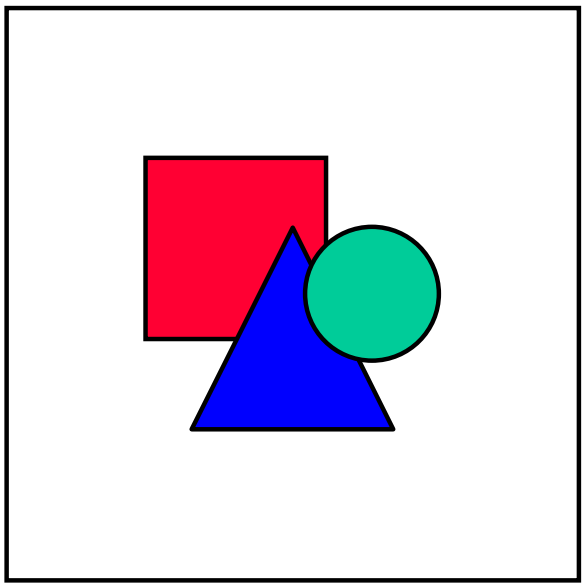
> ***Thailand's high efficiency motor program offers interest-free loans for three years at US$440 per kW saved***

EGAT allocated 195 million baht (US$ 7.8 million) for the refrigerator program and 1,176 million baht (US$ 47 million) for the air-conditioners program.

Thailand Environment Institute (TEI), a private organization, is developing a green labeling scheme for a variety of products. Four of these products—energy-saving fluorescent lamps, environmentally sound refrigerators, low-energy air-conditioners, and high-efficiency industrial motors, are energy-consuming ones. The criteria for eco-labeling for these four products includes energy consumption. The labeling scheme is voluntary. TISI, NEPO, and EGAT are all engaged in TEI's efforts.

[211] From GEF Midterm Review of Thai DSM program 1996.
[212] Na Phuket 1998.
[213] Salisdisouk, June, 1998
[214] Na Phuket 1998.

Figure 30. Thailand's Ecolabel



Monitoring and Enforcement

The Energy Conservation Promotion Act does not provide specifications on enforcement.

Impact Data and Evaluation

Of the five-year program's total 311 MW savings goal, the refrigerator program aimed to save 27 MW and the air-conditioners program aimed to save 22 MW. Not only has the program reached these goals, but it has exceeded them, reducing peak demand by almost half of 1 percent.[215]

The appliance energy labeling programs exceeded nearly all targets more than eight months ahead of schedule (see Table 38). The programs have reduced peak demand by 65 MW and avoided nearly 500,000 tons of CO_2. The cost effectiveness of the labeling program has also been extremely high. EGAT estimates that the cost of saved energy for all of its DSM programs has been just US$0.012/kWh, compared to EGAT's long-run marginal cost of US$0.05/kWh. The labeling program has been the least expensive and most cost effective of EGAT's programs. The low implementation cost was achieved because manufacturers implemented the program voluntarily, without any subsidy. The primary cost to EGAT has been the nationwide television marketing campaign.

> ***The cost of saved energy for all of its DSM programs has been just one-fourth EGAT's long-run marginal cost. The labeling program has been the least expensive DSM program.***

Table 38 shows EGAT's estimates of savings.

[215] du Pont 1998.

Table 38. Savings Achieved with Thai Labeling Programs[216]

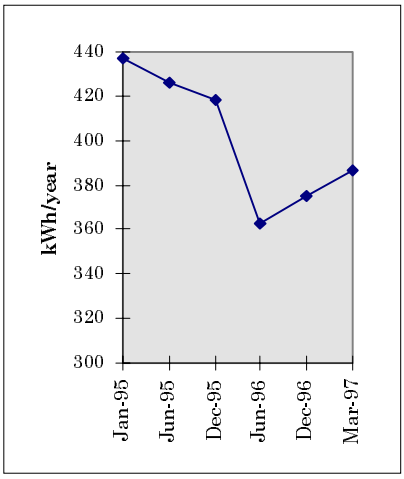
Product	Peak MW Savings		Gwh/yr Savings		CO_2 Reductions
	Target (Dec 98)	**Achieved (Apr 98)**	Target (Dec 98)	**Achieved (Apr 98)**	**Achieved (Apr 98)**
Refrigerator	27	**48 (178%)**	186	**366 (197%)**	**273,000**
Air Con	22	**17 (77%)**	117	**277 (237%)**	**207,000**
Total	49	**65 (133%)**	303	**643 (212%)**	**480,000**

When the refrigerator program began in February 1995, only one model earned the rating of five. Only a year and half later, the refrigerator market had shifted dramatically. At the start of the program, 32 percent of the participating refrigerators (i.e. refrigerators for which manufacturers requested labels) were rated at 3; 55 percent were rated at 4; and 13 percent were rated at 5. By the end of 1996, the number of participating refrigerators had more than doubled; and 70 percent of participating models were rated at 5.[217] Since then, the market has shifted even more as manufacturers have made incremental improvements to achieve a rating of 5, rather than a rating of 4.

No comprehensive study has evaluated the impact of the labeling programs. However, initial estimates from the DSM Office and other sources indicate that the programs have encouraged manufacturers to increase their production of high-efficiency models and to modify existing models in order to make them energy-efficient.[219] Determining the actual impact of the programs is quite difficult due to the lack of baseline market data. EGAT derived its estimates by tracking the number of labels with each rating shipped to manufacturers, rather than tracking unit sales.[220]

Figure 31 shows EGAT's estimated reduction of energy consumption, based on the number of labels issued by EGAT. Average energy use of refrigerators participating in the program dropped by 14 percent.

Figure 31. Average Energy Consumption of Refrigerators, Thailand[218]



The efficiency improvements made by the refrigerator manufacturers have been incremental and have included increasing the door insulation and improving the gasket seals on the door.[221] EGAT and the manufacturers reached an agreement that manufacturers could concentrate on meeting the national, non-CFC requirements that were targeted for January 1997 before being required to improve compressor efficiency. They agreed that using non-CFC refrigerants increases energy consumption of refrigerators by 10 percent, and thus EGAT adjusted the base case refrigerator energy consumption from 485 kWh/yr to 533 kWh/yr.[222]

Thus far, only Sanyo Universal Electric has fundamentally changed its refrigerator design by increasing the thickness of the wall insulation. Thus, despite the swift and substantial shift in the market, there remains significant room for additional efficiency gains.

[216] Salisdisouk, December, 1997.
[217] EGAT data from DSM Office Marketing Department, March 1997.
[218] The energy consumption of the refrigerators began rising in June 1996 due to compliance with the Montreal Protocol. In response to this, EGAT is revising its mean energy consumption (upon which is based the label categories) to 534 kWh/ year. This will serve as the new baseline for CFC-free refrigerators. Salisdisouk, December,1997.
[219] du Pont, Amranand, Ratanopas and Mehta.
[220] du Pont, Amranand, Ratanopas and Mehta.
[221] Lemoine.
[222] Salisdisouk, December 1997.

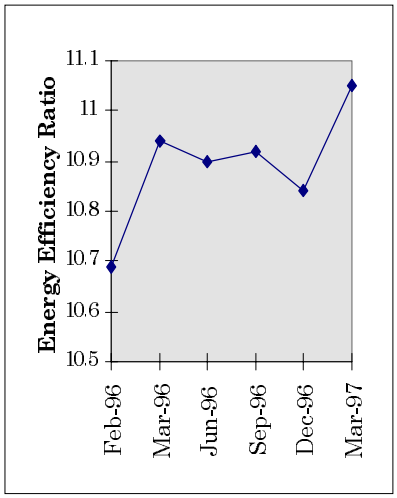
The DSM success can be attributed to both market pull from consumer demand and market push from the voluntary agreements by manufacturers.

The program for air-conditioners built on the success of the refrigerator program and started with testing the efficiency of models on the market in November 1995. Air-conditioners produced by multinational corporations received the highest ratings. These firms launched large promotional campaigns touting the energy-saving benefits of their products. There was an almost instantaneous obsolescence of the label: manufacturers only chose to place the label on their unit if it had a rating of 5, since 4 was not perceived to be marketable. Thus, consumers were faced with a choice -- between buying a unit with a label (i.e. a rating of 5) or a unit with no label (i.e. a rating of 4, 3 , or worse). Figure 32 shows EGAT's estimated reduction in energy consumption based on the number of labels issued. The average energy-efficiency rating (EER) of air-conditioners participating in the program increased by 4 percent.

As a result of the DSM program, all of the air-conditioner manufacturers have joined the air-conditioner trade association; previously, only fifteen of the fifty-five manufacturers were association members.

The success of the programs is likely due to both market pull from consumer demand and market push from the voluntary agreements made by manufacturers. There is a high level of consumer recognition of the Thai energy label. EGAT launched a consumer awareness campaign touting the importance of saving energy to complement the energy labeling programs. A national survey of 971 Thai appliance consumers in 1997 found that the Thai appliance labeling program was successful on a number of levels: [223]

Figure 32. Average EER of Room Air-conditioners, Thailand



- Energy efficiency was a high priority in the purchase decision. Energy efficiency was mentioned by 28 percent of consumers as being among their top-three purchase criteria.
- The great majority of Thai consumers understood the basic meaning of the label and could use it to identify whether a model was energy-efficient.
- Well over 50 percent of recent purchasers of refrigerators and air-conditioners asked to see models with an energy label or used the label explicitly in their decision process.
- Just two years after the start of the program, 9 of 10 Thai consumers who recently purchased an appliance were aware of the labeling program. This is much higher than the 50-60 percent awareness rate found among U.S. appliance consumers in 1983, three years after the initiation of the U.S. labeling program. These findings reflect the effectiveness of the national television advertising campaign launched by the Thai DSM Office.
- Consumers supported a government role in promoting energy efficiency. Nearly all of the consumer surveyed (>95 percent) expressed support for the

[223] du Pont, Amranand, Ratanopas and Mehta.

government's role in the appliance labeling program, and 76 percent expressed a desire to see the government do more to promote energy efficiency.

The Thai appliance label is very effective in enabling consumers to identify efficient models

The HEM motors program has not achieved the impressive results of the air-conditioner and refrigerator labeling programs. EGAT is having difficulty convincing motor manufacturers to participate in the voluntary program. The program has been in operation for only a little over a year, and no significant energy savings were achieved.[224]

Outlook

Currently, the Thai government is in the process of establishing minimum efficiency standards for air-conditioners, refrigerators, ballasts, and industrial motors.

EGAT is planning to make the labeling program for refrigerators mandatory. EGAT is collaborating with OCP. The first step will to require manufacturers participating in the labeling programs to label all models on the market. EGAT also plans to expand the labeling program to cover electric fans, frost control, heat pipes, variable speed drives, absorption chiller, lighting controls and two other products. The government has announced plans to expand the labeling program to cover fans, motors, and incandescent and fluorescent lamps. EGAT will introduce labeling in conjunction with DEDP in 1998.

EGAT's demand-side management office is offering zero-interest loans to customers purchasing air-conditioners that carry the highest efficiency ratings. For models rated "4", EGAT offers a zero-interest loan of 5,000 baht. For models rated "5", EGAT the loan amount is 10,000 baht. These loan amounts represent roughly 25-30% of the purchase cost.[225]

[224] Na Phuket 1998.
[225] Salisdisouk, December, 1997.

Viet Nam

Summary

No energy standards or labels have yet been introduced. The government is considering initiating a demand-side management program, and it is likely that standards and labeling would be included.

Energy Policy and Institutions

Although coherent energy policies have been proposed, no concrete, integrated policy that deals with energy and efficiency has been implemented.[226] The Institute of Energy has prepared a document, "National Energy Policy, " which would establish policies for supply and demand sectors.[227] However, the government has yet to accept this policy.

> ***Viet Nam's Energy Conservation and Efficiency Master Plan is now pending before the National Assembly.***

In 1995, the Ministry of Science, Technology, and the Environment (MoSTE) began an Energy Conservation and Efficiency Program, and since has been responsible for developing the Master Plan for Energy Conservation and Efficiency for Viet Nam.

The first phase of the Master Plan was completed in June 1997, and resulted in an energy savings potential assessment and an action plan. During the second phase of the program, slated for completion in June 1999, MoSTE will draft policy and develop projects for energy conservation potential for 1998-2000. During this phase of the project, energy-efficiency standards will be developed for buildings and energy-efficiency standards and labeling will be developed for materials and equipment.[228]

The estimated demand impact for standards and labeling is shown in Table 39.

Table 39. Estimated Demand Impacts for Potential DSM Programs, Viet Nam[229]

Program	Year 2002 MW reduction	Year 2010 MW reduction	Year 2010 GWh savings	Benefit/ cost ratio	NPV US$M
Commercial Building codes	0	109	1051	1.9	38
Residential lighting standards	37	91	272	6.7	80
Industrial lighting	0	9	70	1.7	4
Motors standards	11	36	322	35.5	39
Total	48	245	1715	3.6	161

Testing Facilities

There are no facilities for energy efficiency testing.

Testing Procedures

Testing procedures will be selected and developed when the standards and labeling programs are designed.

[226] Lew and Prijyandonda.
[227] Institute of Energy.
[228] This section is drawn from Lew and Prijyandonda.
[229] Hagler Bailly Services.

Standards

There are no energy standards in Viet Nam. However, energy standards will be considered during the Second Stage (1998-2000) of the Master Plan work.

Labeling

No energy labeling or eco-labeling programs exist.

Monitoring and Enforcement

When energy standards are developed, MoSTE would be the agency to enforce the standards.[230]

Impact Data and Evaluation

No standards or labeling programs exist yet.

Outlook

Standards and labeling programs will likely be initiated in 1998 through the draft Master Plan for Energy Efficiency and Conservation. The Ministry of Science, Technology and Environment hosted the first consultative seminar on the Plan in March. The products under consideration for mandatory standards are lighting equipment, industrial motors, fans, refrigerators, washing machines, and air-conditioners. To complement standards, labels may also be introduced.

[230] Thuong.

Lessons Learned

Very few evaluations of the existing standards and labeling programs in Asia have been conducted. Below, our analysis of several programs is based primarily on IIEC's field interviews with professionals involved in standards promulgation.

Few Asian programs have been evaluated.

Because each country is unique—culturally, economically, and politically—lessons learned may not apply across borders. Experiences of other countries can inform the development of national programs, but straight adoption from one context into another is likely not appropriate. For instance, voluntary labeling programs in Thailand and Hong Kong have achieved vastly different participation rates from manufacturers, due to divergent political economies. This is particularly true of transposing program designs from developed countries, such as the United States, Europe, Australia, and Japan, to developing Asian economies. Very few evaluations have been completed for Asian programs. We intend this section to serve only as a preliminary attempt to address this gap in program evaluation. More detailed analyses are needed.

Some lessons may be applicable to countries with similar contexts. Some generalized recommendations are:

General Lessons

- **Manufacturer participation should be solicited.** Manufacturers should be involved at all stages of program development. It is essential that standards reflect sound and balanced needs of the various sectors, if they are to make substantive contributions to the country's overall development program. Close public-private partnering strengthens programs.
- **Programs should be designed for the particular country conditions.** Energy-performance standards and energy labeling programs should be designed to fit the local manufacturing sector, political processes and institutions, technologies available on the market, and consumer preferences and understandings.

Periodic updating of standards and labels should be built into program design.

- **Laboratories should avoid backlogs.** There should be competent testing personnel and enough capacity to test models in a timely manner. Timeliness is a matter of contention. At a recent meeting regarding product testing in Thailand, participants from testing facilities said there was ample testing capacity. One manufacturer disagreed: he had been waiting six months for a required test to be completed, while his competitors' similar product was already in the market. These conflicting views are typical. A testing facility seeks an even flow of product tests with little or no down time. A manufacturer seeks tests on a schedule which will ensure his product is in the market making money.
- **Testing procedures should be appropriate.** Procedures should reasonably reflect the usage patterns and climate particular to a country. This will help build

consumers' confidence that the test results accurately reflect the energy usage they will experience.

- **Selected testing procedures should be international.** One criteria for selecting testing procedures is how commonly the procedure is used internationally. Internationally harmonizing testing procedures will better enable consumers to compare the energy performance of models tested in different countries.
- **Marketing experts should design labels.** Labels should be designed with input from marketing experts and consumer organizations so that labels are user-friendly.
- **Categorical-comparative style labels are best.** Labels which compare all models on the market allow consumers to "comparison shop." Labels which rank or categorize models are preferable to labels with detailed information and technical terms.
- **Programs should be enforced.** Compliance with voluntary and mandatory standards and labels must be ensured through a credible enforcement scheme for a program to be effective.
- **Programs should be evaluated.** Impact and program evaluation is critical to sustained success. Impact calculations provide a basis for maintaining and building political support for energy efficiency standards and labeling programs. Evaluating each component of a program provides a basis for continual improvement in the effectiveness of the programs.
- **Programs should be supported by policy.** An energy policy framework that is conducive to energy efficiency is critical to the longevity of a national standards regime. Legislation and regulation are powerful approaches to initiating programs, providing there is adequate enforcement.
- **Ratcheting should be built into programs.** The design of energy performance standards and energy labeling programs should include a mechanism which regularly and periodically upgrades performance standards and recalibrates energy labels.
- **Programs should be complemented by advertising.** Consumer understanding of the linkage between environment and energy may determine whether an energy-labeling program succeeds. Consumer awareness campaigns and environmental education should be pursued to support labeling regulation or programs.

Country-Specific Lessons

Below are lessons learned specific to the countries in which the programs were developed. Some of these lessons may be applicable to other contexts.

- **Voluntary Schemes May Be Inadequate. (Hong Kong)** The air-conditioner and refrigerator voluntary labeling programs have so far garnered the participation of few manufacturers. Hong Kong's labeling program is not complemented by a widespread consumer awareness campaign, a DSM program, a rebate scheme, or manufacturer incentives. It is possible that the stand-alone nature of the program impedes greater participation. However, it should be borne in mind that the labeling schemes are young, and participation rates are currently climbing.

- **Seminars Improve Manufacturer Participation. (Hong Kong)** To address the low manufacturer participation rates in the labeling schemes, the Consumer Council and UN-ESCAP organized a seminar in March 1997. The seminar enumerated the benefits of participation. Before the seminar, no room air-conditioners were labeled; however, during the seminar, three importers announced their intention to register, and since then the total number of participants has risen to ten.[231]

- **Retailer Involvement is Critical. (Hong Kong)** Some retailers have not kept energy labels on the appliances. Recent research showed that usually only one or two labeled appliances can be found in any one shop.[232] The Consumer Council concludes that retailers should be involved more in the implementation of the labeling scheme.

- **Implementing Agencies Should Have Both Authority to Promulgate Standards and the Mandate to Promote Energy Efficiency. (India)** In India, an institutional gap exists. The Energy Management Centre has no authority to develop policy, or issue standards or labels, but is the governmental agency responsible for promoting energy efficiency. While The Bureau of Indian Standards has that authority to issue standards and mandatory labels, it has wider, and more consuming responsibilities to develop safety and quality standards.

- **A Lot Can be Done with A Little. (Philippines)** Philippine standards and labeling efforts have been intense and effective. They also have been accomplished on a shoestring budget. Although the government laboratory's equipment is in need of an upgrade, laboratory staff have an excellent quality assurance system in place, and thus are credible to manufacturers. In addition, standards and labels are being developed through a consensus process, and have proceeded despite the lack of data and engineering and economic analyses. Additional resources would strengthen the Philippine program, but excellent progress has been made on a limited budget.

- **Inclusive and Frequent Communication Creates Trust and Transparency. (Philippines)** Philippine standards and labeling programs have proved successful due to close partnering between government agencies and the private sector. Rather than forcing a tough set of standards on the manufacturers, the government established a Technical Committee to develop the standards and labeling programs. The Committee meets monthly, and includes all interested parties. Constant communication between government agencies and manufacturers has created complete transparency of the process, and with this, a spirit of trust and goodwill. One government official remarked that all are working together like "brothers and sisters."

- **Manufacturers Are Key Allies. (Philippines)** The Technical Committee is chaired by the president of the trade Association of Home Appliance Manufacturers (AHAM), who was elected by the Committee's members. A forward-thinking champion of standards and labeling, the president at points even urged the government to move more aggressively on already-ambitious schedules.[233] He has effectively communicated the trade and market advantages of improving product efficiency to the association members, thus overcoming potential opposition. Association members view him as the "father of the industry," and his leadership has ensured 100 percent manufacturer participation at meetings. Some potential manufacturers have even attended to provide input.

[231] Li.
[232] Li.
[233] Hernandez.

A forward-thinking champion of standards and labeling, the president of the Philippines' Association of Home Appliance Manufacturers urged the government to move more aggressively on already-ambitious schedules.

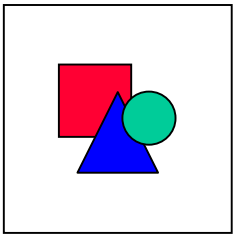
- **Switching to Non-Ozone Depleting Substances and Improving Efficiency Can Happen Simultaneously. (Philippines)** Personally committed to preventing ozone depletion and improving the natural environment, AHAM's president has pushed forward the transition from ozone-depleting coolants to more ozone-friendly substitutes before compliance with the Montreal Protocol is required. At the same time, energy-efficiency requirements are continuing to be ratcheted upwards. Because manufacturers only have to retool once and only need to pursue one round of research and development, manufacturers see the cost-effectiveness of concurrent CFC phase-out and energy efficiency improvements.

- **A Credible and Efficient Laboratory is Critical. (Philippines)** The testing and certification aspect of the Philippines' program was temporarily contentious. At the inception of the Philippines air-conditioner program, the testing results of FATL were challenged by a manufacturer, but after outside testing confirmed FATL's results, the laboratory gained credibility with industry and facilitated their support of the program.

- **Standards Should Be Periodically Adjusted. (Singapore)** Singapore introduced building codes over fifteen years ago. There was no built-in ratcheting system in place for updating the standards. Consequently, building efficiency stopped improving. The same problem has stymied the Australian labeling program. Presently, most models on the market fit into the upper categories of the label, thus depriving manufacturers of a motive to further improve product efficiency. (Australia and New Zealand are now revising and recalibrating the label.) Without introducing a system for periodic adjustments, the market will stop transforming.

- **Ad Campaigns Influence Consumers. (Thailand)** Publicity to support Thailand's labeling programs and other DSM efforts made EGAT Thailand's largest single advertiser in 1995. The US$8 million nationwide advertising campaign is beautiful, professional, and pervasive. Research indicates the public is highly aware of the importance of saving energy, and this encourages purchases of more efficient appliances.[234] And, EGAT's commitment to the publicity campaign provided an incentive for manufacturers to participate in the labeling programs.

Figure 33. EGAT's TV ad campaign



[234] du Pont 1998.

"The higher the number, the more you save," says a Thai soap opera star as part of EGAT's TV ad campaign

EGAT's commitment to the publicity campaign encouraged manufacturers to participate in the labeling programs

- **Programs May Increase Overall Demand for Energy-Consuming Devices.[235] (Thailand)** An unintended impact of the Thai air-conditioners program has resulted from the associated publicity and marketing efforts. The program increased the appeal of air-conditioners to the general public. Air-conditioner demand may increase significantly in contrast to earlier projections.

- **Voluntary Programs Can Attain High Manufacturer Participation. (Thailand)** In Thailand, EGAT and the manufacturers have worked closely together to craft arrangements that are agreeable to both parties. This spirit of collaboration has resulted in effective voluntary agreements with high compliance rates. The concentration of government and industry leaders in Bangkok and the importance accorded to consensus may contribute to the success of the voluntary approach.[236]

- **Supportive Policies Strengthen Standards and Labeling Programs. (Thailand)** Energy labeling is couched in a broader DSM program in Thailand. The overall approach to demand-side management has been to supplement voluntary programs with nationwide campaigns and interest-free loans to customers. Although there has been no evaluation done of the interest-free loans, the high profile EGAT accords the voluntary labeling efforts through advertising has undoubtedly increased manufacturer participation and consumer awareness.

- **Lack of Competitive Pay Scales May Harm Programs. (Thailand)** Thailand's civil service regulations are an obstacle to the development of human resources to carry out energy-efficiency programs.[237] NEPO, a department within the civil service, cannot recruit staff above a certain government ranking from the private sector. Top managers must work their way up from entry-level. Regulations also prevent qualified people from rising too quickly within their organizations. As a result, many upper-level positions in NEPO remained officially vacant during the agency's first five years, even though there were qualified personnel within the agency. These same problems hinder the development of human resources at the Department of Energy Development and Promotion and the Thailand Industrial Standards Institute. EGAT's hiring practices are less restrictive than those of the civil service, but the pay scale for EGAT employees is also well below that of the private sector.[238]

- **Categorical Labels Communicate Clearly with Consumers. (Thailand)** An evaluation of the Thai label has revealed that the energy label design is highly-effective in communicating with consumers. Most Thais in the survey understood the label, as compared to Americans asked to interpret the US label.[239] The prominence of the comparative rating scale contributes to the readability of the label.

[235] du Pont, Amranand, Ratanopas and Mehta.
[236] du Pont, Amranand, Ratanopas and Mehta.
[237] du Pont, Amranand, Ratanopas and Mehta.
[238] One precedent for such a move is the Securities Exchange Commission to regulate the Stock Exchange of Thailand. Another is the Thailand Research Fund, which was established in 1992 under the Prime Minister's Office.
[239] du Pont, 4 December 1997.

Needs Assessment

Asia is confronting several barriers to effective implementation and strengthening of national standards and labeling programs. This section presents an overview of needs and actions. We then specifically assess the best next steps within each of the developing economies examined. Finally, we offer a list of priorities for decision-makers involved in designing energy-efficiency policy.

The momentum towards initiating standards and labeling has been growing for the past five years in Asia. At this time, policy-makers in most countries appreciate the cost-effectiveness of using standards and labels to achieve reductions in energy consumption. This is not true in all countries or at all government levels, and there remains a need to persuade high-level policy-makers of the benefits of standards and labeling. Nevertheless, most of the countries surveyed are considering initiating or expanding standards and labeling.

> ***Most of the countries surveyed are considering initiating or expanding standards and labeling.***

The next steps in Asia are technical: to establish testing infrastructure, design energy labeling programs, and develop energy-efficiency standards. As shown in the scan of country programs, some countries in Asia have significant experience developing these technical programs. This experience could be effectively utilized in many other Asian countries through South-South exchanges (i.e. exchanges between developing countries). Additionally, lessons from other parts of the world would enrich current initiatives.

Addressing the Barriers

Table 40 summarizes the barriers discussed in the introduction, and the general actions needed to address these needs.

Table 40. Overview of Needs and Actions

Need	Action
Inadequate energy efficiency testing capacity	***Strengthen Testing Infrastructure.*** Many countries in Asia have inadequate testing infrastructure and human capacity for assessing the efficiency of energy-consuming products. Some countries do not have energy-efficiency testing at all; others have understaffed laboratories or have trouble retaining qualified personnel; equipment at other laboratories is poor. There is a need for training laboratory personnel – both at the testing level and at the technical manager level. Technical assistance is also needed to establish and upgrade laboratory facilities.
Lack of technical information on testing procedures selection, methodologies for setting minimum energy performance standards (MEPS), and label and labeling program design	***Create Information Clearinghouse.*** Technical information about how other standards and labeling programs have been established around the world is not readily available to many Asian decision-makers. The need for information exchange was stated at a recent conference in Bangkok.[240] Participants recommended setting up an information clearinghouse to share technical information, compile data, and identify financial and technical resources for training, infrastructure development, and program initiation. The clearinghouse should house a bulletin board to facilitate direct communications between professionals. ***Offer Technical Training.*** Focused training would build technical capacity to select testing procedures, set standards, and design labels. USAID, through the Institute of International Education, has completed several standards-related regional courses for policy-makers. This curriculum, broadened to include the experiences of many countries which have already have functioning programs, could be sharpened and sectioned into in-depth topical skills transfer courses. Topics for courses include: conducting engineering and economic analysis for setting standards, using consumer focus groups to inform label design, establishing adequate testing infrastructure, and promulgating standards and labeling energy conservation legislation.
Lack of knowledge about Asian successes and lessons	***South-South Information Exchanges.*** Currently, few forums have provided Asian standards-related professionals an opportunity to trade information about existing programs. Forums focused around relating successes and setbacks in Asia would provide professionals with guidance about how to adapt the experiences of other countries to the unique climatic, cultural and manufacturing sectors of Asia. One Chinese professional recently said, "We want to have more chance to exchange with other countries, especially Asian countries."[241] There is ample experience from other countries on developing standards regimes which could guide the design and implementation of labeling and minimum standards. "Success stories" from Japan, Thailand, the Philippines, Australia, Korea, United States and the European Union should be shared. Small meetings between high-level government officials would provide an opportunity to coordinate national standards regimes. Broader conferences would allow professionals of many levels to trade insights and methodologies.
Low public awareness	***Advertising Campaigns.*** Creating market pull requires basic consumer understanding about the importance of energy efficiency as a national goal as well as a money-saver. In Asia, advertising is dominant in shaping attitudes. Already, there is a proven success to build from in Asia: the Thai advertising campaign which supports EGAT's labeling program. The advertisements successfully linked energy efficiency with patriotism in the public mind. The power of media can be harnessed to support standards and labeling programs. Marketing expertise must be solicited to create effective public messages. One of the principal impediments to launching a campaign is how resource-intensive slick and pervasive advertising is. Although the required resources are large, the Thai program has proved that benefits outweigh the costs. Depending on cultural contexts, this may also be true in other Asian countries. ***Educate Children, the Media, and Politicians.*** Another mechanism for shaping public opinion is education. Environment and energy curriculums for schools need to be developed. Other influential members of society are

[240] IIEC, 14-16 July 1997.
[241] Xin, December 1997.

	politicians and journalists and media professionals. Educational efforts, such as one-on-one meetings and press kits, can help shape their opinions.
Lack of baseline data on the market	***Develop Baseline Data.*** The lack of reliable market data is currently one of the largest barriers for DSM planning and evaluating the impact of standards and labeling programs. In the early stages of program development, more emphasis should be placed on collecting market data in order to develop baseline efficiency levels.[242]
Lack of awareness among high-level policy-makers	***Develop "White Paper."*** A White Paper on standards and labeling would document the benefits of establishing national standards regimes. The paper would concisely present data from programs in different countries, and describe consumer, manufacturer, national energy balance, and environmental benefits of standards and labeling. As more evaluations are conducted of Asian programs, this data could be added to the document.
Lack of impact and program evaluations	***Conduct Impact and Program Evaluations.*** While other types of energy efficiency are typically subject to impact and process evaluations, standards and labeling programs are often neglected.[243] This information is essential for planning future efficiency programs, as well as for improving existing ones. The evaluations also provide justification for continuing or expanding current programs. In particular, program evaluations, which examine the adequacy of testing infrastructure, the ability of the label to communicate with the consumer, and whether standards are eliminating inefficient models from the market, provide insights about program design that could inform the development of initiatives in other countries.

Recommended Actions

Since each country scanned has unique manufacturing sectors, institutional arrangements, energy policies, priorities, and technical expertise, we discuss below specific needs country-by-country. The countries discussed are the seven with developing economies and with demonstrable interest in energy efficiency efforts: China, India, Indonesia, Malaysia, Philippines, Thailand and Viet Nam. We define our recommendations according to the general action areas defined in the above table. The recommendations are based on the following criteria:

- fit with national plans for next steps on standards and labeling
- demonstrated interest from concerned organizations in pursuing action
- institutional strength and political will to carry out the proposed actions
- need for external resources

Regional Actions

Action	Notes
Information Clearinghouse	This has been proposed already at the Forum on Asia Regional Cooperation on Energy Efficiency Standards and Labeling. Pelangi Indonesia has indicated interest in housing the electronic portion of the clearinghouse.

[242] du Pont, Amranand, Ratanopas and Mehta.
[243] du Pont, Amranand, Ratanopas, and Mehta.

Technical Training	Some initial training has been sponsored by USAID for participants from Indonesia, the Philippines, and India. In addition, several professionals from China are being trained in economic and engineering analysis at Lawrence Berkeley National Laboratories. Concept papers for tours on setting standards, designing labels, and establishing testing facilities have been drafted by New Zealand's Energy Efficiency and Conservation Authority. The Fuels and Appliance Testing Laboratory of the Philippine Department of Energy has indicated initial interest in possibly hosting a training course on testing facilities. There is momentum to capitalize on.
South-South Information Exchanges	Few regional forums have provided the opportunity for policy-makers, consumers and manufacturers to focus exclusively on standards and labeling experiences in the South. Participants at the IIEC Bangkok forum in July 1997 recommended convening meetings to enable these information exchanges.[244]

Country-Specific Actions

Table 41 summarizes the specific actions for each countries.

Table 41. Summary of country-specific actions

Action	*China*	*India*	*Indonesia*	*Malaysia*	*Philippines*	*Thailand*	*Vietnam*
Advertising campaign		✓	✓	✓	✓		
Baseline market data	✓						
Conduct program evaluation					✓		
Establish motors testing facility						✓	
Establishing testing infrastructure			✓	✓			✓
Training in label and labeling program design		✓	✓				
Training in setting up standards regime				✓			✓
Training on deriving standards		✓					
Training on devising standards	✓				✓	✓	
Upgrade testing facilities					✓		

	Action	Notes
CHINA	***Training on devising standards***	China needs technical assistance to draft energy performance standards. Currently standards are promulgated through solely a consensus process, based on little data or analysis. The Technical Committee only receives 10,000 yuan (about US$1,100) to draft one standard. This is barely enough to hold two discussion meetings.[245]
	Baseline Market Data	The efficiency of products on the market is not known. This is especially true for air-conditioners and industrial motors.

[244] IIEC, 14-16 July 1997.
[245] Xin, 7 December 1997.

INDIA	***Training in Label and Labeling Program Design***	Efforts are now underway through BIS's Technical Committees to develop voluntary labeling programs for a variety of products. In-depth capacity building is needed as the programs are designed. USAID has been supporting related activities.
	Training on Deriving Standards	Very few people in India are trained to perform engineering and economic analysis to derive energy performance standards.[246] This analysis would be useful input to Technical Committee meetings at BIS.
	Advertising Campaign	To complement energy labeling efforts, advertising would heighten consumer demand for more efficient products. An active consumer movement exists upon which to build advertising and education initiatives.
INDONESIA	***Establish Testing Infrastructure***	The Asian Development Bank has plans to technically assist in setting up new facilities to test air-conditioners and refrigerators for energy efficiency. This is a key prerequisite to program development. Involving other organizations in this effort, such as manufacturers and NGOs, will ensure the usage of the facility. The laboratory's personnel need to be trained.
	Training in Label and Labeling Program Design	The government has begun drafting labels for a voluntary program, but has not conducted market research to determine the efficacy of different designs. Assistance to Indonesia could take the form of targeted training for policy-makers or as direct technical assistance to the government or the utility.
	Advertising Campaign	To complement energy labeling efforts, advertising would heighten consumer demand for more efficient products. An active consumer movement exists upon which to build advertising and education initiatives.
MALAYSIA	***Establish Testing Infrastructure***	Malaysia has no facilities for assessing energy efficiency and the national lab, SIRIM, is currently undergoing privatization. This activity would necessitate selecting an adequate institution to house the laboratory, then building the capacity to conduct energy-efficiency testing.
	Training in Setting Up Standards Regime	UN-ESCAP sponsored two seminars in 1997 to provide information to government, university, private sector, and consumer group parties interested in setting up a labeling program. Technical training in devising standards and designing labels would build on these initial seminars.
	Advertising Campaign	To complement energy labeling efforts, advertising would heighten consumer demand for more efficient products. An active consumer movement exists upon which to build advertising and education initiatives.

[246] Bhatia, February 1998.

PHILIPPINES	***Upgrade testing facilities***	FATL facilities house old testing equipment. Better equipment is needed to test air-conditioners and refrigerators.[247] Although FATL earns sufficient user fees to upgrade its equipment, all earnings under law must be deposited in the national treasury, and are thus unavailable to fund upgrades. A suitable financial arrangement should be devised so as to sustainably fund energy-efficiency testing.
	Conduct Program Evaluation	The success of the Philippine room air-conditioner standards and labeling program has not been assessed by an outside evaluator. Only the impact on energy consumption has been estimated. Other impacts need to be measured.[248] In addition, no program evaluation has been conducted, and both FATL and BPS staff believe it is necessary. There is a special need to evaluate the label design before it is replicated for the products slated for labeling over the next two years.
	Advertising Campaign	There have been limited public awareness activities in the Philippines due to lack of resources to produce advertisements, and lack of human resources within the responsible government agencies to do marketing work. Publicizing and explaining the label are key components which are currently lacking.[249]
	Training in Devising Standards	The Philippines has at least four products for which standards and labels are being made. However, there are no impact assessments for different standards levels. There is a need to analyze the markets, and estimate the impact of standards on national energy savings, consumer costs, manufacturers, and the environment.[250]
THAILAND	***Establish Motors Testing Facility***	Thailand is planning to establish energy performance standards for industrial motors. However, there is no energy-efficiency testing capacity. The World Bank has been working with MEA to develop plans for a laboratory, but the project recently has not moved forward.
	Training in Devising Standards	Thailand plans to strengthen its voluntary labeling programs with energy performance standards. Currently, NEPO and DEDP have limited human capacity to devise standards levels through economic-engineering or statistical analysis. There is a need for human resources development.

[247] Campañano, February 1998.
[248] Fuels and Appliance Testing Laboratory staff.
[249] Hernandez.
[250] Fuels and Appliance Testing Laboratory staff.

VIET NAM	***Establishing Testing Infrastructure***	No facilities in Viet Nam currently perform energy efficiency testing. In MoSTE's Master Plan, standards and labeling programs will be developed. Testing capability is a prerequisite.
	Training in Setting Up Standards Regime	A overview training course in the components of setting up a standards regime would be useful for government professionals charged with implementing the Master Plan. Topics would include testing procedure selection, policy framework, supportive programs, standards and labels derivations, and establishing testing infrastructure.

Conclusion

Environmental concerns and pressures of constrained capacity are stimulating the adoption of standards and labeling programs in Asia. In just five years, numerous standards and labeling efforts have developed into full-fledged, successful programs. Several programs can serve as models, not only within the Asian region, but also for developing countries struggling with similar constraints and barriers throughout the world.

Appendix

Standards Organizations

The following listing provides contact information for some organizations that have been involved in initiating or implementing standards and labeling programs in their home countries or abroad. The list is by no means exhaustive, but is rather meant as a starting point for people interested in a technical information or a particular country's activities.

ASEAN Energy Management and Training Research Center

AEEMTRC is a research institution serving ASEAN.

Contact name: Hassan Ibrahim
Tel: +62 (21) 739-8279
Fax: +62(21) 722-6011
E-mail: aeemtre@rad.met.id

Asian GRoup for Energy Efficiency

At a technical colloquium held in July 1997, the Asian GRoup for Energy Efficiency (AGREE) issued recommendations on technical modifications for different energy efficiency testing procedures for air-conditioners, refrigerators, and electric motors. The participants agreed that regional harmonization of testing procedures would remove a trade barrier and reduce testing costs for manufacturers marketing in several nations.

Contact names: David Cogan / Kristina Egan
Tel: +644 470-2231/ +662 381-0814
Fax: +644 499-5330/ +662 381-0815
E-mail: cogand@moc.govt.nz/ kegan@loxinfo.co.th

Asia Pacific Economic Cooperation forum

APEC has established the Steering Group on Energy Standards. The group is investigating the benefits and potential for aligning energy efficiency testing procedures between the APEC economies.

Contact name: John Cockburn, Natural Resources Canada
Tel: +613 996-4359
Fax: +613 947-4120
E-mail: john.cockburn@es2.es.emr.ca

Beijing Energy Conservation Center

BeCon works on technical preparation of standards for China.

Contact names: Wang Wenlai / Xin Dingguo
Tel: +86(10) 697 37024
Fax: +86(10) 697 32059
E-mail: becon@public3.bta.net.cn

Bureau of Product Standards, Department of Trade and Industry, Philippines

BPS has worked with the Fuels and Appliance Testing Laboratory to develop the energy efficiency testing, standards and labeling program for the Philippines.

Contact name: Norma Hernandez
Tel: +63(2) 890-4965
Fax: +63(2) 890-4926
E-mail: bps@dti.gov.ph

Consumer Council of Hong Kong

The Consumer Council has been active in developing and supporting the voluntary energy labeling program.

Contact name: Brian Cheng
Tel: +85(2) 2856-8585
Fax: +85(2) 2856-3611
E-mail: yncheng@netvigator.com

Electrical and Mechanical Services Department, Hong Kong

EMSD has prepared and implemented the voluntary labeling program in Hong Kong.

Contact name: Ronald Chin
Tel: +85(2) 2881-0770
Fax: +85(2) 2890-6081
E-mail: eedeec@emsd.gcn.gov.hk

Electricity Generating Authority of Thailand

EGAT is implementing the voluntary labeling program in Thailand.

Contact name: Nophdol Salisdisouk
Tel: +66(2) 436-6340
Fax: +66(2) 433-3329

European Commission

The European Commission has been instrumental in creating standards and labels for the European Union and in Eastern Europe.

Contact names: Paolo Bertoldi / Matthew Kestner
Tel: +32(2) 295-2204
Fax: +32(2) 295-5852
E-mail: Paolo.BERTOLDI@BXL.DG17.cec.be

Fuels and Appliance Testing Laboratory, Department of Energy, Philippines

FATL has worked with the Department of Trade and Industry to develop the energy efficiency testing, standards and labeling program for the Philippines.

Contact name: Mirna Campañano
Tel: +632 927-7201/ 929-5443
Fax: +632 929-5474
E-mail: doefatl@skyinet.net

International Energy Agency

The International Energy Agency, located in Paris, France, has been active in documenting the environmental and energy benefits of standards and labels.

Contact name: Jean-Pierre des Rosiers/ Benoit Lebot
Tel: +331 40-57-6711
Fax: +331 40-57-6749
E-mail: desrosiers@iea.org /benoit.lebot@iea.org

International Institute for Energy Conservation

IIEC's global standards initiative aims to build national standards regimes through national level technical assistance and regional cooperation.

Contact name: Peter du Pont / Kristina Egan
Tel: +66(2) 712-6057 to 58
Fax: +66(2) 381-0815
E-mail: ptdupont@loxinfo.co.th / kegan@loxinfo.co.th

Jyunkankyo Research Institute

The institute has been involved in researching the energy efficiency standards appropriate for Japan.

Contact name: Hidetoshi Nakagami
Tel: +81(3) 5845-2111
Fax: +81(3) 5845-2123
E-mail: KYD00464@niftyserve.or.jp

Korean Energy Management Corporation

Contact name: Sunil Kwon
Tel: +82(2) 520-0155
Fax: +82(2) 525-0630
E-mail: kemco163@chollian.dacom.co.kr

Lawrence Berkeley National Laboratory

LBNL's International Energy Efficiency Standards program technically assists developing countries in creating and applying standards and labeling.

Contace name: Isaac Turiel
Tel: +1(510) 486-6493
Fax: +1(510) 486-6996
E-mail: i_turie@lbl.gov

Ministry of Science, Technology and the Environment, Viet Nam

MoSTE is developing Viet Nam's Energy Conservation and Efficiency Master Plan. Standards and labeling are components.

Contact name: Nguyen Thuong
Tel: +84(4) 261-843
Fax: +84(4) 252-733

Ministry of Trade, Industry and Energy, Korea

The ministry has been involved in designing and implementing Korea's energy efficiency programs.

Contact name: Mi-Chung Ahn
Tel: +82(2) 500-2747 to 48
Fax: +82(2) 504-5001

National Energy Policy Office, Thailand

NEPO is in the process of developing energy efficiency standards for products in Thailand.

Contact name: Pongpisit Viseshakul
Tel: +66(2) 280-0951 to 57
Fax: +66(2) 282-4607
E-mail: visesha@mozart.inet.co.th

United Nations-Economic and Social Commission for the Asia and the Pacific

UN-ESCAP has completed a series of forums related to standards and labeling. Events have been held in Iran, Malaysia and Viet Nam.

Contact name: Ralph Wahnschafft
Tel: +84(4) 288-1542
Fax: +84(4) 288-1059
E-mail: wahnschafft.unescap@un.org

University of Indonesia

The University of Indonesia has a testing laboratory for appliances. The university has been working with the government to develop standards and labeling program schematics.

Contact name: Rinaldy Dalami
Tel: +62(21) 770-7941
Fax:+ 62(21) 786-6461
E-mail: rinaldy@makara.cso.ui.ac.id

Universiti Teknologi Malaysia

UTM is working on developing standards and labeling for Malaysia.

Contact name: K.S. Kannan
Tel: +607 550-2408
Fax: +607 557-0020
E-mail: prakan@pl.jaring.my

Internet Information Sources

American National Standards Institute
http://www.ansi.org/

Department of Energy and Mines in Australia
http://www.qgd.qld.gov.au/mines-energy/min-toc.html

Department of Natural Resources, Canada
http://www.emr.ca/

Electricity Generating Authority of Thailand
http://www.egat.or.th/

Energy Conservation Center, Japan
http://www.eccj.or.jp/index_esu.htm

Energy Star Program of US Environmental Protection Agency
http://www.epa.gov/appdstar/esoe/international.html
for testing procedures measuring Energy Star:
http://www.epa.gov/appdstar/esoe/international.html

Global Ecolabelling Network
http://www.interchg.ubc.ca/ecolabel/gen.html

IEC
http://www.iec.ch/

International Institute for Energy Conservation
http://www.iiec.org

ISO
http://www.iso.ch/

Lawrence Berkeley National Laboratory
http://www.lbl.gov/LBL-PID/LBNL-intro.html

National Institute of Standards and Technology (NIST)
http://www.nist.gov/

NUTEK
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