2. Energy-Efficiency Labels and Standards: An Overview

Guidebook Overview Prescriptions

1. Verify that efficiency labels and standards are appropriate as a basic element of your country's energy policy portfolio.
2. Apply your scarce resources to the products likely to provide the greatest public welfare.
3. Select/announce programs for specific products only when you've identified the necessary resources.
4. Allocate sufficient time and resources to adopt a common product-testing procedure for each major appliance. Focus first on certification of test laboratories and test facilities; if appropriate, leave actual testing to manufacturers and third-party testing organizations. Whenever possible, participate in regional or global harmonization of test procedures, and establish alliances with other nations working toward that goal.
5. Plan for involvement of manufacturers and all other interested stakeholders at appropriate stages in the processes of program design, label design, label specifications development, and standards-setting.
6. If you're new to standards-setting and labeling and have very limited resources, consider starting with a voluntary labeling program until you are comfortable and the stakeholders are ready for a more ambitious program.
7. Allocate sufficient time and resources to analyze the effects of any potential standards. The more the standards level remains grounded in a thorough, objective technical analysis, the greater the likelihood of political sustainability and subsequent compliance.
8. Be open to input from all stakeholders, and proceed in a transparent and responsive manner. Focus on what is best for the country in the long term. Be prepared to withstand strong political pressure.
9. Allocate sufficient resources to monitor, evaluate, and report the impacts of programs.

2.1 Definition of Energy-Efficiency Labels and Standards

Before discussing the many aspects of energy-efficiency labels and standards that follow, we define exactly what is meant by these two terms.

2.1.1 Labels

Energy-efficiency labels are informative labels affixed to manufactured products to describe the product's energy performance (usually in the form of energy use, efficiency, or energy cost); these labels give consumers the data necessary to make informed purchases. We distinguish in this guidebook between two types of labels:

- endorsement labels and
- comparative labels.

Endorsement labels are essentially "seals of approval" given according to specified criteria. Comparative labels allow consumers to compare performance among similar products using either discrete categories of performance or a continuous scale.

Energy labels can stand alone or complement energy standards. In addition to giving information that allows consumers who care to select efficient models, labels also provide a common energy-efficiency benchmark that makes it easier for utility companies and government energy-conservation agencies to offer consumers incentives to buy energy-efficient products. The effectiveness of energy labels is heavily dependent on how they present information to the consumer and on how they are supported by information campaigns, financial incentives, and other related programs.

2.1.2 Standards

Energy-efficiency standards are procedures and regulations that prescribe the energy performance of manufactured products, sometimes prohibiting the sale of products that are less efficient than a minimum level. The term "standards" commonly encompasses two possible meanings: 1) well-defined protocols (or laboratory test procedures) by which to obtain a sufficiently accurate estimate of the energy performance of a product in the way it is typically used, or at least a relative ranking of its energy performance compared to that of other models; and 2) target limits on energy performance (usually maximum use or minimum efficiency) based on a specified test protocol (McMahon and Turiel 1997). The term "norm" is sometimes used instead of "standard" in Europe and Latin America to refer to the target limit. In this guidebook, we use the term "test protocol" for specifications regarding testing and "standards" for target limits on energy performance that are formally established by a government.

There are three types of energy-efficiency standards:

- prescriptive standards
- minimum energy performance standards (MEPS)
- class-average standards

Prescriptive standards require that a particular feature or device be installed in all new products. Performance standards prescribe minimum efficiencies (or maximum energy consumption) that

manufacturers must achieve in each and every product, specifying the energy performance but not the technology or design details of the product. Class-average standards specify the average efficiency of a manufactured product, allowing each manufacturer to select the level of efficiency for each model so that the overall average is achieved.

2.1.3 Mandatory vs. Voluntary Programs

Is it best to make labels or standards mandatory? What if manufacturers and importers are legally required to meet standards but generally do not adhere to them, as reportedly happened in Europe during the 1960s and 1970s (Waide et al. 1997)? Is the mere threat of mandatory standards enough to make a voluntary program effective? Switzerland successfully took this approach (Waide et al. 1997). Japanese manufacturers routinely meet "voluntary targets" even though Japanese regulations make no mention of enforcement or penalties for not meeting these targets. In Japan, the threat of public disclosure of non-compliance is sufficient deterrent to make voluntary targets effectively mandatory (Nakagami and Litt 1997, Murakoshi 1999).

Endorsement labeling programs are inherently voluntary. If the program includes a comparison label, the program can be either voluntary or mandatory or could start as voluntary and evolve to being mandatory later.

Deciding whether labels or standards should be legally binding is only one aspect of the process of designing a compliance mechanism. The goal is to affect the behavior of importers, manufacturers, salespeople, and consumers. Successful programs may combine any balance of legal, financial, and social considerations, depending on the structure, economics, and culture of the society.

2.1.4 Individual Products vs. Product Class

Is it better to set a standard that restricts the energy consumption of every individual product or to set a standard that controls the average energy efficiency for a class of products?

Most standards that have been set for refrigerators, freezers, clothes washers, clothes dryers, dishwashers, air conditioners, lighting products, and other household and office products have so far applied to each unit of every model manufactured. Manufacturers have the discretion to use any combination of technologies to meet a particular standard. For example, one refrigerator manufacturer may rely on an especially efficient compressor to meet a new standard while another may rely on a super-insulating door. Manufacturers test each model they offer and are expected to control production quality so that every unit meets the standard within a specified tolerance. Compliance can be checked relatively easily by testing any unit.

Switzerland, Japan and the European Union (E.U.) (through its negotiated agreements) are noted exceptions. These countries give manufacturers the discretion to achieve differing levels of energy efficiency in various models so long as the overall energy-savings target is achieved. This additional flexibility in the

mix of products gives manufacturers the opportunity to find creative and economically efficient ways to achieve the desired overall efficiency improvement. However, it requires a more elaborate and sophisticated procedure for assessing and enforcing compliance and adds considerable complexity to manufacturer production and shipment schedules. Because the average is an aggregation of different efficiencies of different models, it depends heavily on the relative sales of the different models, which creates uncertainty about whether the class average will actually meet the target on the reporting date for compliance with the standards.

2.2 Rationale for Energy-Efficiency Labels and Standards

Energy-performance improvements in consumer products are an essential element in any government's portfolio of energy-efficiency policies and climate-change-mitigation programs. Governments should develop balanced programs, both voluntary and regulatory, that remove cost-ineffective, energy-wasting products from the marketplace and stimulate the development of cost-effective, energy-efficient technology, as shown in Figure 2-1. In some circumstances, mandatory requirements are effective. When designed and implemented well, their advantages are that:

- they can produce very large energy savings
- they can be very cost effective and helpful at limiting energy growth without limiting economic growth
- they require change in the behavior of a manageable number of manufacturers rather than the entire consuming public

Standards shift the distribution of energy-efficient models of products sold in the market upward by eliminating inefficient models and establishing a baseline for programs that provide incentives for "beating the standard." Labels shift the distribution of energy-efficient models upward by providing information that allows consumers to make rational decisions and by stimulating manufacturers to design products that achieve higher ratings than the minimum standard.

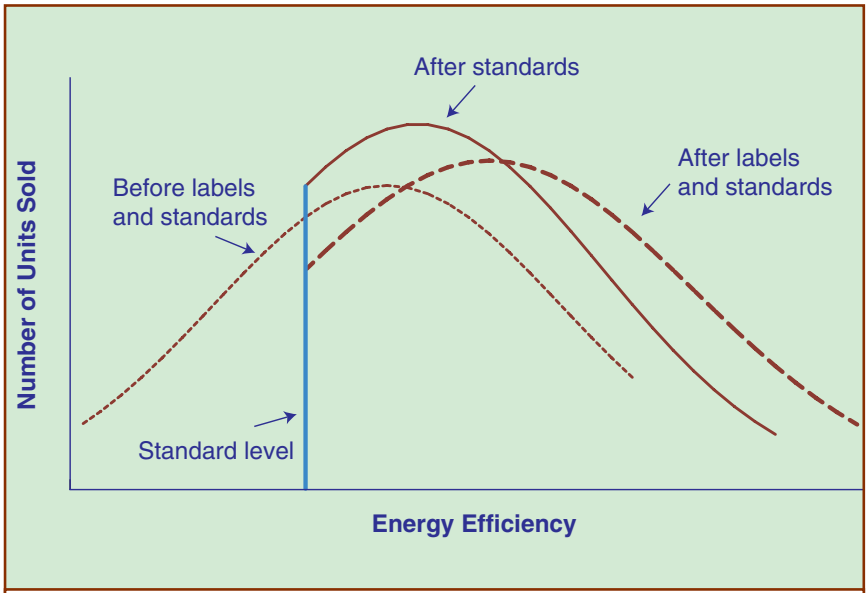

Figure 2-1 The impact of energy-efficiency labels and standards on the distribution of products in the marketplace: The Concept

- they treat all manufacturers, distributors, and retailers equally
- the resulting energy savings are generally assured, comparatively simple to quantify, and readily verified

The above benefits can easily be nullified if programs are not designed and implemented effectively.

The effect of well-designed energy-efficiency labels and standards is to reduce unnecessary electricity and fuel consumption by household and office equipment, e.g., refrigerators, air conditioners, water heaters, and electronic equipment. Reducing electricity use reduces fuel combustion in electric power plants. Cost-effective reduction in overall fuel combustion has several beneficial consequences. The six most significant of these benefits are:

- reducing capital investment in energy supply infrastructure
- enhancing national economic efficiency by reducing energy bills
- enhancing consumer welfare
- strengthening competitive markets
- meeting climate change goals
- averting urban/regional pollution

As individual nations around the world increasingly adopt and expand standards-setting and labeling programs, the harmonization of elements of these programs often brings additional benefits, primarily:

- reducing program costs by adopting program elements from trade partners
- avoiding or removing indirect barriers to trade
- avoiding the dumping of inefficient products on trading partners (see insert: *Dumping Inefficient Products on Trade Partners that Have Weak or No Standards*)

Dumping Inefficient Products on Trade Partners that Have Weak or No Standards

In an unusual twist, a recent study that benchmarked the performance of air conditioners among five Asian economies found that the "developing" countries (China, Korea, Malaysia, and Thailand) were "dumping" inefficient air conditioners on the more developed countries (Australia), which at the time did not have a minimum efficiency standard for air conditioners. In part as a response to the report, Australian manufacturers and distributors have agreed to speed the adoption of minimum standards for air conditioners, in order to keep the inefficient imported models off the market (Danish Energy Management 2004).

The benefits of standards and labeling programs are described in the following subsections.

2.2.1 Labels and Standards Reduce Capital Investment in Energy Supply Infrastructure

In industrialized countries, energy consumption by appliances, equipment, and lighting is already substantial. Energy use per capita has generally stabilized, and total energy use in buildings is growing roughly proportionally to population growth. In developing countries, by contrast, energy consumption in buildings is generally much lower than energy consumption in buildings in industrialized nations but

is growing rapidly as more people use particular types of appliances and per-capita energy consumption increases. For example, Denmark, with a Gross Domestic Product (GDP) per capita of US$39,647, had total per-capita energy use of 154 megajoules in 2002, which had been growing at the rate of 0.02% per year during the previous 10 years. In the same year, Thailand with a per-capita GDP of US$3,000, had total per-capita energy use of 57 megajoules, with per-capita energy growth during the same 10-year period of 4.3% per year (IEA 2002). Most other countries (excluding the economies in transition of the former Soviet Union) have growth rates that fall between these two examples. Countries that expect rapid energy growth (which is most countries) face the uncomfortable need to invest hard currency in energy-consuming products and new power plants to supply the resulting energy needs.

Improvement in the energy efficiency of an electricity-, natural-gas-, or other fuel-consuming product reduces the amount of energy that the product uses. If the product consumes electricity and operates at times of peak power demand, the improved efficiency also reduces demand for new power plants. The investment that would be required for new power plants is vastly more expensive than the increased cost of designing and manufacturing energy-efficient components for the energy-consuming products that these power plants service. For example, an unpublished analysis by Ernest Orlando Lawrence Berkeley National Laboratory (LBNL) in the mid 1990s showed that if improvements in energy efficiency averted 20% of Pakistan's projected energy demand during the following 25 years, Pakistan would need US$10 billion less in hard currency for capital investments in power plants, transmission lines, and fuel. At the time, these efficiency improvements could have cost as little as $2.5 billion, with a portion of that in local currency. In other words, efficiency labels and standards are a highly cost-effective way to reduce future investments in expensive power plant construction, freeing capital for more economically advantageous investments in the energy sector, such as compact fluorescent lamp (CFL) manufacturing facilities or basic health and educational services.

2.2.2 Labels and Standards Enhance National Economic Efficiency by Reducing Energy Bills

The above rationale of reduced future investments applies equally to spending on fuel. Efficiency labels and standards reduce future investments in fuel acquisition, delivery, and use. The amount that is spent in the energy sector of any country in any year siphons money away from other sectors. Because much energy-sector spending directly supports production of other goods and services, a more efficient energy sector results in a more efficient economy.

Considering Pakistan as an example again, the 20% reduction in energy consumption discussed above would have reduced the country's electricity-to-GDP growth-rate ratio from the then-current range of 1.0 to 1.5, which was steadily increasing the relative energy cost in the economy, to a more desirable range of 0.8 to 1.2, which would have freed much hard currency for other important social and economic expenditures.

Perhaps the comparison of investment in energy-efficiency standards and labels to investment in power production shown in Figure 2-2 is the best way to demonstrate the economic benefits. The figure shows

that, over its entire history, the U.S. energy-efficiency standards program has avoided the need for supplying additional electricity at a cost that is one-third that of actually having to supply it.

The cost of avoiding electricity use with energy-efficiency standards is far less than the cost of having to supply it.

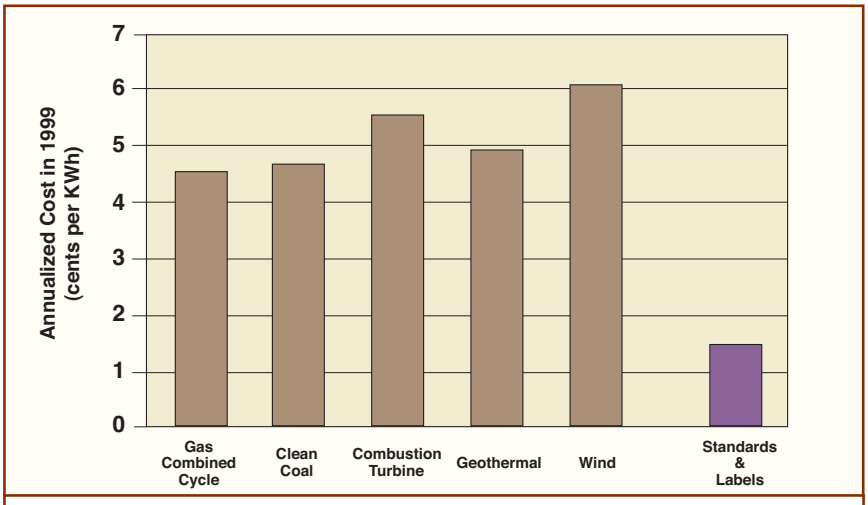

Figure 2-2 The cost of electricity in the U.S. from various new sources
Source: U.S. Energy Information Administration's National Energy Modeling System and (Meyers 2004)

2.2.3 Labels and Standards Enhance Consumer Welfare

When applied appropriately, labels and standards can boost energy efficiency and enhance consumer welfare. In the U.S., for example, the number of refrigerator models and features available to consumers has increased since efficiency standards have been put in place, and purchase prices have been even lower than those expected and justified by regulators (Greening et al. 1996). The average amount of electricity needed to operate a new refrigerator in the U.S. has dropped by 75% since standards were first announced in the state of California almost 30 years ago even though new refrigerators have enhanced features and larger capacity. (It is important to note, however, that, if inappropriately and unnecessarily applied, standards can limit choice, add to product cost, and disrupt trade.)

2.2.4 Labels and Standards Strengthen Competitive Markets

If designed effectively, energy-efficiency standards and improved products can make local businesses more profitable in the long run; make local appliance, lighting, and motor manufacturers more competitive in the global marketplace; and make local markets more attractive for multinational commerce. By contrast, unnecessary and inappropriate standards can undermine burgeoning new local industries at a time when access to capital and other resources is limited. In addition, standards can have either a positive or negative effect on trade, by purposefully or inadvertently creating or removing indirect trade barriers.

There are many anecdotes and various views on the effects of standards on individual companies, and many manufacturers claim that they have been unsuccessful in maintaining margin on incremental

product costs after the implementation of energy-performance standards. The desired outcome seen by some stakeholders is not always the actual outcome, as evidenced by consolidation of manufacturers in the U.S., and, in some cases, a shift of domestic manufacturing jobs offshore.

In sum, the application of new standards offers a government an opportunity to effect a change in its nation's business environment. The desired outcome is a strengthened competitive market in the long run although there is the risk that some manufacturers will be distressed in the short run.

2.2.5 Labels and Standards Meet Climate-Change Goals

Energy-efficiency labels and standards can help a country meet climate-change goals. Reducing electricity consumption decreases carbon emissions from fossil-fuel power plants. For example, appliance standards currently in effect in the U.S. are projected to reduce residential-sector carbon emissions by an amount equal to 9% of 1990 levels by the year 2020 (Meyers 2004).

2.2.6 Labels and Standards Avert Urban/Regional Pollution

Energy-efficiency labels and standards can help a country avert urban/regional pollution. Reducing energy consumption in buildings also decreases fossil-fuel power plant emissions of sulfur dioxide, nitrogen oxides, particulate matter, and other toxic gases and aerosols.

2.2.7 Harmonized Labels and Standards Reduce Program Costs and Foster Global Trade

As labeling and standards-setting programs proliferate, international cooperation is becoming increasingly advantageous in reducing the resources needed for developing these programs and in fostering global trade by avoiding or removing indirect trade barriers. The International Energy Agency (IEA) identifies several forms of cooperation, including: collaboration in the design of tests, labels, and standards; harmonization of the test procedures and the energy set points used in labels and standards; and coordination of program implementation and monitoring efforts. Such cooperation has five potential benefits (IEA 2000):

- greater market transparency
- reduced costs for product testing and design
- enhanced prospects for trade and technology transfer
- reduced costs for developing government and utility efficiency programs
- enhanced international procurement

Recently, more and more countries have been making a distinction between unilateral alignment of elements of standards-setting and labeling programs with those of trade partners and harmonization of these program elements in multilateral forums and compacts. The benefits from these two approaches to cooperation are basically the same.

Nations joining in regional harmonization activities have expressed differing reasons for their participation, including the desire to:

- improve energy efficiency
- improve economic efficiency (improve market efficiency)
- reduce capital investment in energy supply
- enhance economic development (enhance quality of life)
- avert urban/regional air pollution
- help meet goals to reduce climate change
- strengthen competitive markets (reduce trade barriers)
- reduce water consumption
- enhance energy security

This diversity of reasons for participating in regional harmonization activities has not diminished the commonality of interest in achieving harmonization. Delegations of countries and participants in various regional harmonization efforts have agreed, with little controversy, to seek one or more of the following:

- harmonized test facilities and protocols
- mutual recognition of test results
- common content for comparison energy labels
- harmonized endorsement energy labels
- harmonized MEPS for some markets
- shared learning about the labeling process
- shared learning about the standards-setting process

Furthermore, experience has shown that harmonization is aided by broad agreements on economics and trade, as evidenced, for example, by the harmonization activities of the North American Energy Working Group in support of the North American Free Trade Agreement and of the Expert Group on Energy Efficiency and Conservation within Asian-Pacific Economic Cooperation (APEC) (Wiel and Van Wie McGrory 2003).

The paragraphs above describe the benefits of well-designed and effectively implemented labels and standards. It is important, however, to remember that ill-advised or poorly designed or executed programs can actually harm consumers, manufacturers, and other stakeholders, as well as the overall economy and the environment. Some examples of negative effects of ineffective efforts are worth noting. With regional cooperation, formal harmonization of standards by treaty rather than voluntary unilateral alignment might result in adoption of a "least common denominator" that may restrain the more progressive

countries. A regional harmonized approach might also add administrative complexity and delay the process. Perceptions that a country is surrendering sovereignty to other countries as part of a harmonization effort can create political impediments as well. In national programs, inattention to detail in the development and implementation of the program can have especially devastating impacts on poor consumers or small manufacturers. Standards that are too weak, endorsement labels placed on average-performing products, and comparison labels that communicate poorly offer little relief from high utility bills or from low-quality products. Standards that are too strong can cause overinvestment in energy efficiency, resulting in overly stressed manufacturers and in consumers paying, on average, more for a product than they will recover in utility-bill savings. This in turn decreases national economic efficiency. Careful attention to the issues raised in this guidebook can help countries avoid some of the pitfalls mentioned above.

2.3 History and Scope of Energy-Efficiency Labels and Standards

Conceptually, energy-efficiency labels and standards can be applied to any product that consumes energy, directly or indirectly, as it provides its services. The national benefits of labels and standards applied to the most prevalent and energy-intensive appliances, such as household refrigerators, air conditioners, water heaters and electronic equipment, are, initially, generally substantially higher than the cost of implementing the labels and standards programs and producing the efficient products. The stringency of initial standards is typically ratcheted up over time to accelerate the adoption of new technology in the marketplace, and the threshold criteria for endorsement labels are similarly raised over time. Likewise, the bandwidth or definition of categories for comparison labels is updated over the years. The need for periodic ratcheting and the cost effectiveness of any increases in standards levels will be uniquely determined for any product by the rate at which new technology is developed and the rate at which manufacturers voluntarily invest to incorporate this new technology into their product lines. The benefits from labels or standards for less common or less energy-intensive products, such as toasters, are often too small to justify the costs.

The first mandatory minimum energy-efficiency standards in modern times are widely believed to have been introduced as early as 1962 in Poland for a range of industrial appliances. The French government set standards for refrigerators in 1966 and for freezers in 1978. Other European governments and Russia introduced legislation mandating efficiency information labels and performance standards throughout the 1960s and 1970s. Much of this early legislation was weak, poorly implemented, had little impact on appliance energy consumption, and was repealed during the late 1970s and early 1980s under pressure to harmonize European trading conditions (Waide et al. 1997). The first energy-efficiency standards that dramatically affected manufacturers and significantly reduced the consumption of energy were mandated in the U.S. by the state of California in 1976. These standards became effective in 1977 and were followed by U.S. national standards that became effective starting in 1988. By the beginning of the year 2000, 43 governments around the world (including the 15 original members of the E.U.) had adopted at least one mandatory energy-efficiency standard. By 2004, the number had increased to 55 (including the addition of the seven E.U. accession countries that did not already have a program).

The beginning standards level set for each product has varied by country. For countries designing standards to have long-term impact, the intent is for standards to become increasingly stringent over time as part of the basic strategy, noted above, for coaxing newly emerging energy-efficient technology into the marketplace. Development of new technology is never ending although the ultimate efficiency of some product components is limited by natural laws (for example, the vapor compression system used for refrigerators and room air conditioners is limited by the theoretical Carnot cycle). Nevertheless, humans are inherently innovative, and rates of efficiency improvement vary widely over the full range of appliances, equipment, and lighting products. Refrigerator standards in the U.S. are the most dramatic example of emerging technology and the ratcheting effect, which can be seen vividly in Figure 2-3.

Comparison labeling programs have developed in parallel with standards. In 1976, France introduced mandatory comparison labeling of heating appliances, boilers, water heaters, refrigerators, clothes washers, televisions, ranges, and dishwashers. Japan, Canada, and the U.S. soon followed suit with programs covering these and other products. U.S. labels enacted by law in 1975 took effect under the name EnergyGuide in 1980 for major household appliances. No new mandatory labeling programs were undertaken until Australia adopted one in 1987. The Australian program, like the eight additional programs that were created around the world throughout the 1990s, also covers major household appliances (Duffy 1996).

Energy-efficiency standards are the primary reason that the average new refrigerator sold in the U.S. today uses one-quarter the electricity of the average new refrigerator manufactured 30 years ago.

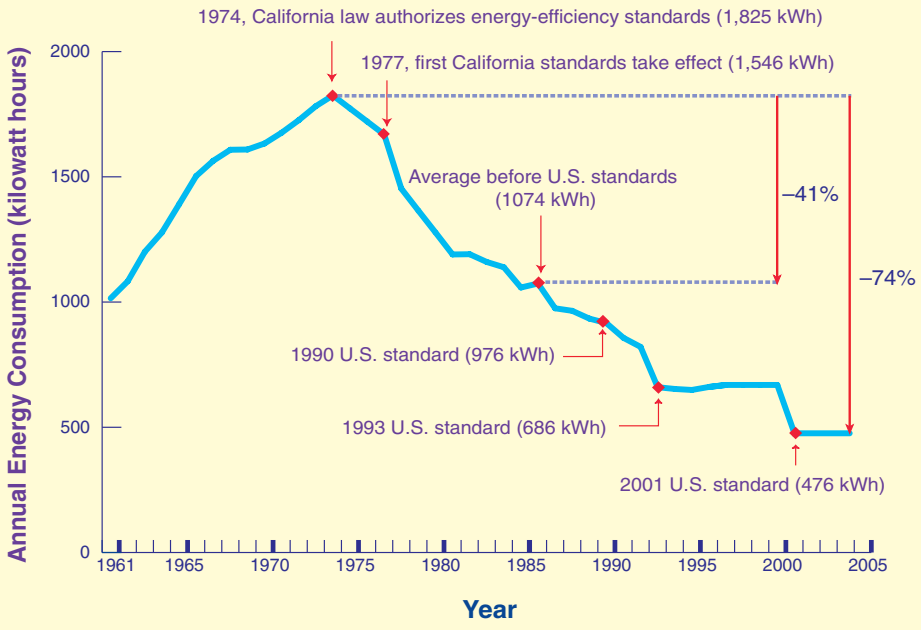

Figure 2-3 The power of ratcheting the stringency of standards: the example of U.S. refrigerator standards

Table 2-1 The Status of Energy-Efficiency Labels and Standards (as of September 2004)

Year: Date in which a country's first standard or label became effective

Fuel Type: B = building shell, D = diesel, E = electric, G = gasoline, N = natural gas, W = water, O = distillate oil

Fuel Type	Product	1966	1976		1978	1979	1981	1983		1984	1985	1986		1987	1989			1992	1993	
		France	U.S.	Germany	Canada	Japan	Taipei China	FSU***	Russia	Brazil	Israel	Australia	New Zealand	India	China	Malaysia	Norway	EU****	Czech Republic	Singapore
E	Refrigerators	LS	LSL	L	LSL	LS	LS	LS	LS	LS	LS	LSL	LS	LSL	L[4]SL	L	LSL	LSSL	LSL	L
E	Freezers	S	LSL		LS	LS	L	LS	LS	LS	LS	LSL	LS		L	L	LSL	LSSL	LSL	L
E	Kimchi Fridges																			
E	Clothes Washers	L	LSL	L	LSL		L			LS	LS	LS	L		LS		LSL	LSL	LSL	L
EN	Clothes Dryers		LS	L	LS		L			L		LS	L				L	L	L	L
EN	Washer-dryers				LS												L	L	L	
E	Dishwashers	L	LSL	L	LSL		L	S	S	L	LS	LS	L				LSL	LSL	LSL	
EN	Ranges/Ovens	L	L	L	LS	LS	LS	S	S	LS	LS			L			L	L	L	
E	Microwave Ovens			L			L			L					L					
E	Rice Cookers						S								LS					
E	Electric Kettles							S	S											
E	Vacuum Cleaners							S	S								L	L	L	
E	Irons							S	S						S					
E	Icemakers				S															
EN	Water Heaters	L	LS		S	LS	LS	S	S	LS	LS	LS	LS	L	L		S	S	S	L
	Solar Water Heaters					L	L			LS	LS	S								
W	Showerheads		LS							LS		L			L					
E	Showerheads									L										
E	Range Hoods						S			L										
W	Faucets		LS							LS		L			L					
W	Toilets		S									L			L					
E	Toilet Seats					LS														
W	Urinals		S									L								
E	Room Air Cleaners		L																	
E	Room AC		LSL		LSL	LS	LS	S	S	LS	LS	LSL	LS	S	L[5]SL		L	L	L	LS
E	Central AC		LSL		LS	LS				LS		LS	LS		S					
EN	Boilers	L	LSL		S		S			LS							S	S	LS	
O	Boilers		LSL		LS		S													
E	Chillers				S		S					S	S		S[6]					
E	Dehumidifiers		L		LS		L													
E	Fans		L		L		LS				LS				S					
N	Furnaces		LSL		LS					LS										
O	Furnaces		LSL																	
E	Heat Pumps		LSL		LS	S						L	L					L	L	
EN	Pool Heaters		S																	
E	Programmable Thermostats*		L		L															
EN	Space Heaters	L	L			LS				L	LS	LS								
E	Ballasts		LS		S	S				LS		LS	LS		LS	S	S	S	S	L
E	Lamps		LSL		LS	LS	LS			LS	LS	LS[1]	LS	L	LS		LL	LL	LL	L
E	Exit Signs		L		L															
E	Residential Lighting Fixtures		L																	
B	Skylights		L																	
E	Traffic Signals		L		L															
E	Wall packs																			
E	Televisions	L	L		L	LS	L	S	S	L		L	L	L	LS		LS	LS	LS	
E	Digital TV services											L						C		
E	VCRs		L		L	S						L	L		L		LS	LS	LS	
E	DVDs		L		L	S						L			L					
E	TV\VCR and TV\DVD Combination Units		L		L															
E	Set-top boxes		L		L							L			L		S	S	S	
E	Radio Rcvr/Rcdr		L		L							L			S		S	S	S	
E	Portable Personal audio																			
E	Analogue Satelite Receivers																			
E	Home Audio**		L														S	S	S	
E	Answering Machines		L		L															
E	Cordless and mobile phones		L		L															
E	Battery chargers																			
E	Computers		L		L	LS	L	S	S			L	L		L		L	L	L	L
E	Monitors		L		L	L	L	S	S	L		L	L		L		L	LS	LS	L
E	Copiers		L		L	LS	L					L	L		L		L	L	L	
E	Printers		L		L	L	L	S	S			L	L		L			L	L	
E	Fax Machines		L		L		L					L	L		L		L	L	L	
E	Scanners		L		L	L	L					L	L							
E	Multifunction devices		L		L	L	L					L						L	L	
E	Mailing machines		L		L															
E	Hard-disk Drives					S														
E	Drinking Water Coolers (Hot&Cold)		L		L					L										
E	External Power Supplies		L															C		
G	Motors		S		S		S			LS		S	S	L	LS	S		LS	LS	L
E	Pumps									LS							L			
E	Transformers		L		LS	LS	L			LS		S[2]	S				S	S	S	
B	Building insulation		L																	
B	Doors		L		L															
B	Reflective Roof Products		L																	
B	Windows		L		L							L	L							
E	Commercial HVAC		L																	
EN	Commercial Fryers		L																	
E	Commercial Hot Food Holding Cabinets		L																	
E	Commercial Refrigerators		L									LS[3]	LS							
EN	Commerical Steam Cookers		L																	
E	Vending Machines		L			S														
G	Automobiles		L		L	S				LS		L						LS		

L = voluntary labels; **L** = mandatory labels; S = voluntary standards; **S** = mandatory standards; **C** = voluntary code of conduct

This table shows the chronological order in which countries first adopted an energy-efficiency label or standard. Since the indication dates shown for each country, many of the programs have been vastly expanded and updated (i.e., voluntary to mandatory, introduction of new product MEPS or labeling).

1994			1995			1996			1998				1999	2000	2001				2002		2003			2004	
Philippines	Thailand	Switzerland	Hong Kong	Mexico	Poland	GEA countries	Costa Rica	Romania	Colombia	Hungary	Iran	Venezuela	Indonesia	South Africa	Argentina	Peru	Saudi Arabia	Slovenia	Ghana	Turkey	Bulgaria	Egypt	Sri Lanka	Tunisia	EU Accession *****
L	L	LS	L	LSL	LS		LS	LS	LS	LS	LS	LS	L	L	L			L		L	L	LS		LS	LSSL
L		LS		LSL			LS	L	LS	LS	LS	LS			L					L	L	LS			LSSL
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Notes:

*Gas-fired water and space heaters only; Programmable Thermostats are categorized the same as EU Central Heating Controls

**Home Audio includes EU's Audio Systems & Audio Separates

***FSU (Former Soviet Union) identifies as a group the successor nations to the Soviet Union or USSR which collapsed in the early 1990s; this group of 15 countries consists of Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan

****EU (European Union): this table indicates the original 15 E.U. members countries with at least one standard or label in effect; Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom

*****EU Accession: The 10 accession members added to the E.U. in 2004 with at least one standard or label in effect; Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia

[1] effective from October 2004

[2] effective from October 2004

[3] effective from October 2004

[4] effective from March 2005

[5] effective from March 2005

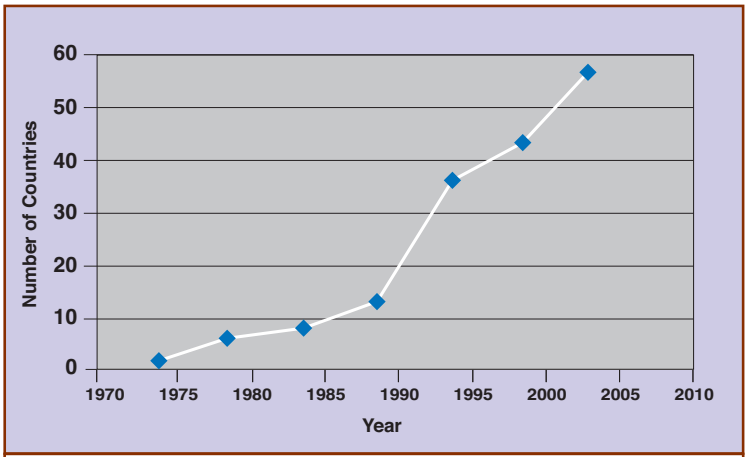
[6] effective from March 2005

[7] effective on a voluntary basis from August 2003; become mandatory from March 2005

Sources: A wide range of sources were consulted in the formulation of this table, including correspondence with in-country experts. For a detailed list of sources, please consult the on-line version of the table at : www.clasponline.org/GB2ndEdition/Chapter2/Table2_1.xls

Recently, a number of countries have initiated programs of voluntary endorsement labeling for energy-efficient products. One of the most extensive and widely known programs is the U.S. ENERGY STAR program. Introduced in 1992 to recognize energy-efficient computers, the ENERGY STAR endorsement labeling program has grown to identify efficient products in more than 40 categories including household appliances, home electronics (televisions, audio systems, etc.), computers and other office equipment, residential heating and cooling equipment, and lighting. Many other countries including Australia, Canada, China, Brazil, and the United Kingdom (U.K.) have subsequently implemented national programs. The International Finance Corporation of the World Bank Group recently launched a multinational Efficient Lighting Initiative that has so far supported endorsement labeling of efficient lighting products in seven developing and transition countries. By 2004, the number of countries labeling at least one product with a comparison label, endorsement label or energy-related ecolabels had grown to 51.

The history of initiation of labels and standards programs during the past three decades and the programs' current status is shown in Table 2-1 on previous pages and Figure 2-4 below. Readers are advised to check www.clasponline.org for updates to Table 2-1.



Since the mid-1970s when they were first introduced, the number of countries that have applied energy efficiency standards and/or labels has grown rapidly.

Figure 2-4 Growth in the number of countries that have adopted at least one standard or label

2.4 Resources Needed for Developing Energy-Efficiency Labels and Standards Programs

The development and implementation of energy-efficiency labels and standards require legal, financial, human, physical, and institutional resources. Each of these already exists to some degree in every country, and each is likely to need at least a little, if not major, bolstering to facilitate an effective labeling or standards program. The remaining chapters of this guidebook address the resources required for each step in the process. Below, we describe one anecdotal experience of the overall magnitude of government spending needed to develop and implement an energy-efficiency standards program.

The U.S. program of national, mandatory energy-efficiency standards began in 1978. By 2004, the program had developed (and, in 17 cases, updated) 39 residential and commercial product standards. During the first 19 years of program, the U.S. government spent US$104 million on developing and implementing these standards, with an average annual expenditure of US$5.5 million and never more than US$11.3 million or less than US$2.3 million in a single year. Annual spending per household was in the range of 2¢ to 12¢ per year for a total of $1.00 over 19 years ($2.00 in constant U.S. dollars). The payback on the increased manufacturer and consumer investments in efficient technology that have resulted from this endeavor has been enormous, as will be demonstrated in the next section.

Other countries that are developing standards and labeling programs can save some program costs by drawing on existing work in the U.S., E.U., Australia, and other countries. Still, undertaking a standards-setting and labeling program requires a serious commitment of resources by the implementing country.

2.5 Effectiveness of Energy-Efficiency Labels and Standards

The effectiveness of energy-efficiency labels and standards is generally reported in the form of: calculations of impacts prepared prior to implementation; anecdotal testimonials; or calculations of impacts based on monitoring of the response to labels and standards once they are in place.

Whether the calculations are made before implementation or after, they are generally based on solid market data. These data usually show the potential or actual impact in a dramatic way, as is the case for clothes-washer efficiency in the U.S. market. Figure 2-5 shows how the U.S.'s 1994 standards shifted the market toward washers that are substantially more efficient. The performance differences in an unregulated market typically range over a factor of three, even more than shown in Figure 2-5 (Adnot and Orphelin 1999). The impact of energy-efficiency labels has likewise been dramatic. The first evaluation of the impact of the recent E.U. labeling scheme showed that

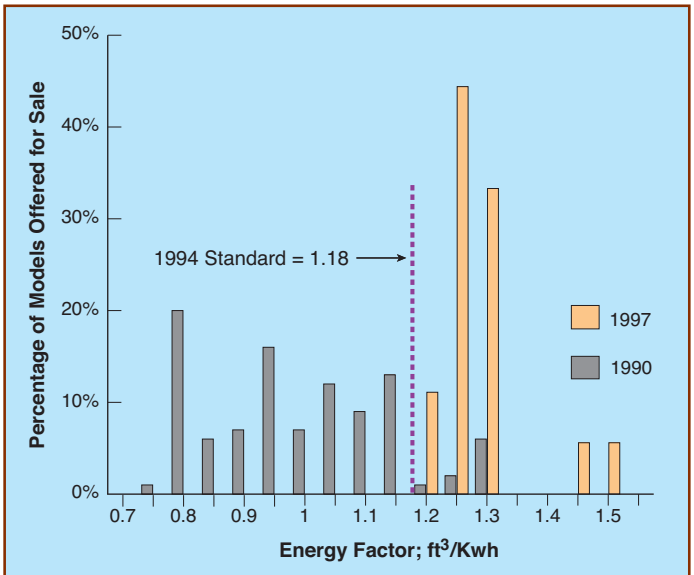


Figure 2-5 The impact of energy-efficiency standards on the distribution of products in the marketplace: clothes washers in the U.S.

An evaluation of the impact of 1994 clothes washer standards in the U.S. shows a dramatic upward shift in the energy efficiency of models offered for sale after the standards were implemented.

An evaluation of the impact of labels and standards in the E.U. shows a dramatic upward shift in the energy efficiency of models offered for sale after the labels and standards were implemented.

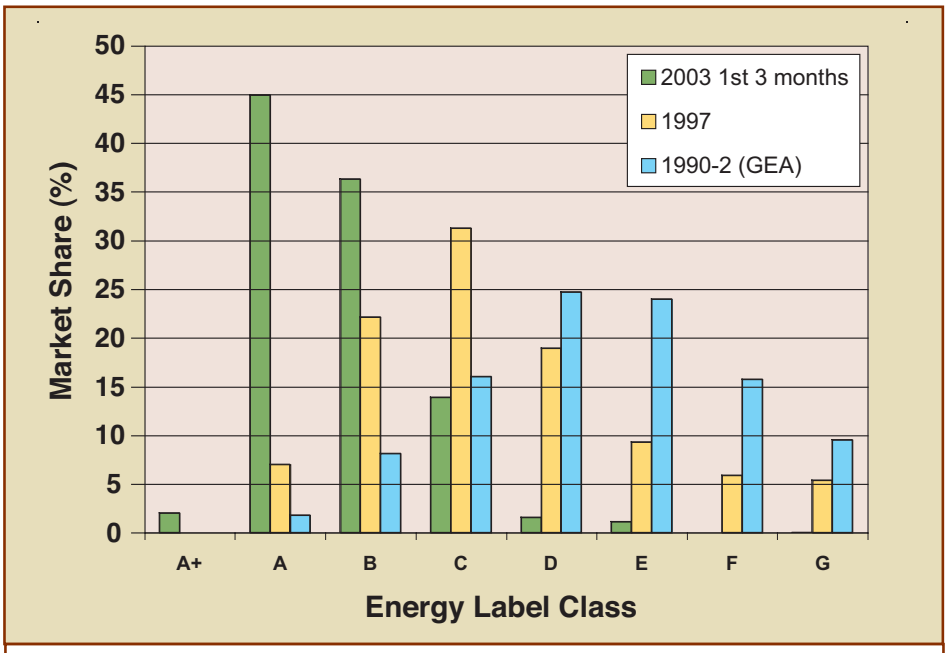


Figure 2-6 The Impact of energy-efficiency standards and labels on the distribution of products in the marketplace: refrigerators in the E.U

the sales-weighted average energy efficiency of refrigeration appliances improved by 26% between 1992 and late 1999, with over one-third of the impact attributable to labeling (Bertoldi 2000). The shift in the efficiency of refrigerators sold in the E.U. is displayed dramatically in Figure 2-6 (Waide 2004, GfK 2003). These assessments clearly imply a huge potential for reducing the energy use of a single product although they fall short of estimating the overall impact of this reduction (e.g., reduction in total energy use, net economic effect, or environmental contribution).

The best example of post-implementation calculations of overall impact is the U.S. claims that energy-efficiency standards adopted to date in the residential sector will result in $130 billion cumulative present-valued dollar savings from reduced energy use over the lifetimes of the products after subtraction of any additional cost for the more efficient equipment. Cumulative primary energy savings during this period are estimated to total 72 EJ. The result in 2020 is expected to be an 8% reduction in residential energy use relative to what would have been the case without the standards. Average benefit/cost ratios for these standards are estimated to be about 2.2 for the U.S. as a whole.

The total $2 per household federal expenditure for implementing the U.S. standards that have been adopted so far is estimated to have induced investment in energy-saving features equaling $1,000 per household, which results in $2,170 gross savings per household in fuel costs, and contributes $1,180 of net-present-value savings per household to the U.S. economy during the lifetimes of the products affected. Projected annual residential carbon reductions in 2020 are approximately 34 metric tons, an amount roughly equal to 9% of 1990 residential carbon emissions (Meyers 2004).

One impact of these mandatory standards is that manufacturers have invested heavily in redesigning full product lines to comply, spending hundreds of millions of dollars in the U.S. alone. This expenditure may have sometimes contributed to consolidation of manufacturers and relocation of production to other countries. For example, prior to the institution of standards for residential air conditioners in the U.S., almost all units sold in the country were made domestically. Now, there is only one company in the U.S. producing residential air conditioners. In developing countries, standards have in some cases protected local manufacturers from foreign competition, but the foreign competition has in other cases overwhelmed local manufacturers. Standards have had a variety of impacts on a country's manufacturing base.

The 2002 annual report on the savings from the labeling of the 34 products that were at that time covered by the U.S. ENERGY STAR program showed annual savings in 2001 of 560 trillion EJ and $4.1 billion. The peak demand reduction resulting from the ENERGY STAR labeling program was 5.7 gigawatts in 2001 and was expected to increase to 7.0 gigawatts in 2002. This report also includes a prospective analysis of the cumulative savings under target market penetrations for the periods 2002–2010 and 2002–2020, respectively, showing that all the products together were expected to save 11 quadrillion Btu (quads) by 2010, growing to 31 quads by 2020 (Weber et al. 2003).

Analyses from elsewhere around the world also report substantial impacts from standards and labeling. During the 1990s, the Demand-Side Management (DSM) Office of the Electricity Generating Authority of Thailand developed a portfolio of 19 DSM measures, including voluntary labeling programs for refrigerators and air conditioners. From 1994 to 2000, the total US$13.7 million that the government spent on these two programs (22¢ per capita) induced spending by consumers on energy-enhancing features of US$80 million ($2.44 per capita) and resulted in a 168-megawatt (MW) reduction in peak power, 1,200-gigawatt hour (GWh) reduction in annual electricity use, and an 860 kiloton reduction in CO_2 emissions. This saved Thai consumers a net $56 million (91¢ per capita) (Singh and Mulholland 2000).

An unpublished study of China's energy-efficiency standards was conducted by the China Center for the Certification of Energy Conservation Products (CECP), the China National Institute of Standardization (CNIS), and LBNL for the U.S. Energy Foundation. This study estimated savings from eight new minimum energy-performance standards and nine energy-efficiency endorsement labels that were implemented from 1999 through 2004 for appliances, office equipment, and consumer electronics. The study concluded that during the first 10 years of implementation, these measures will have saved 200 terawatt hours (TWh) (equivalent to all of China's residential electricity consumption in 2002) and 250 megatonnes of CO_2 (almost 70 megatonnes of carbon) (Fridley and Lin 2004).

Korea shows similar evidence of the impact of labeling, as does the E.U. Figure 2-7 on the next page displays the same type of market shift for refrigerators in Korea that is shown for the E.U. in Figure 2-6 (KEMCO 2003).

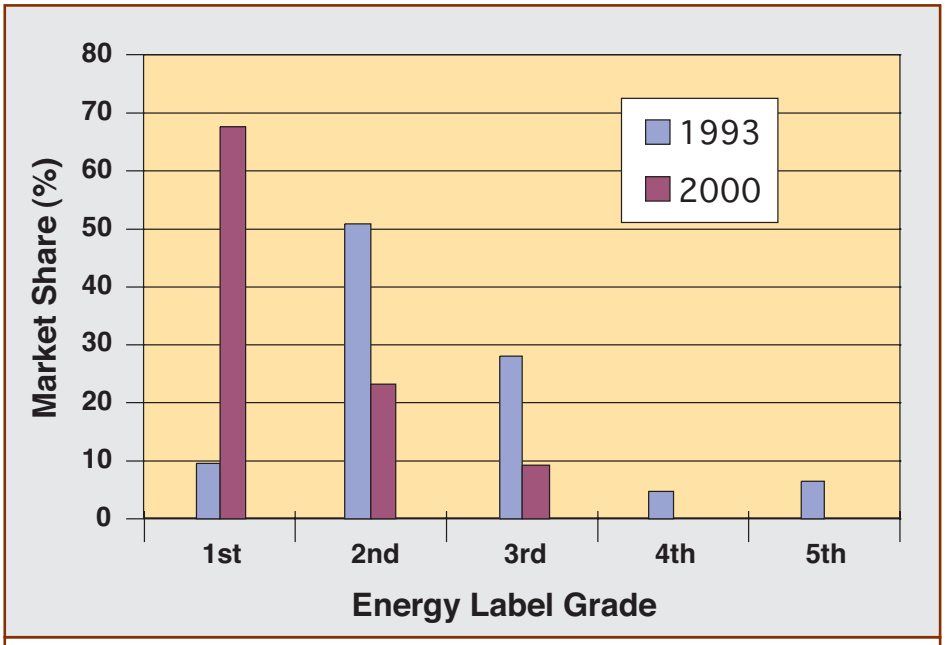


Figure 2-7 The impact of energy-efficiency labels on the distribution of products in the marketplace: refrigerators in Korea

The impact of labels and standards is similar worldwide.

A recent IEA report concludes that if it had not been for the implementation of existing policy measures such as energy labeling, voluntary agreements, and MEPS, electricity consumption in OECD countries in 2020 would be about 12% (393 TWh) higher than is now predicted. The report further concludes that the current policies are on course to produce cumulative net cost savings of 137 billion in OECD-Europe by 2020. Large as these benefits are, the report found that much greater benefits could be attained if existing policies were strengthened (IEA 2003).

An example of a testimonial is the remark of a representative of Bosch-Siemens, a European appliance manufacturer, who was quoted in 1995 as saying "This labelling is having a major effect on our sales ...We see market share decline or rise within even as short as 3 months after labelling commences" (Ginthum 1995). The reader will have no trouble finding such quotes ranging from euphoria (from a Chief Executive Officer whose company dramatically increased market share after labels and standards went into effect) to neutral observations like the example above to despair (from a plant manager whose facility was shut down because of the introduction of new efficient technology). In addition to individual anecdotes, policy shifts are sometimes described, as in this excerpt from the United Nations Foundation (UNF 1999):

> Within the broad area of the changes required in the energy systems of both developing and developed countries, UNF has chosen two specific programmatic areas which would have a highly leveraged impact on the future development patterns of the developing world: energy-efficiency labeling and standards, and community-based rural electrification using sustainable energy technologies.

and this excerpt from a 2004 speech by Ambassador William C. Ramsay, Deputy Executive Director of the IEA (Ramsay 2004):

> Moreover, these regulations (appliance efficiency standards) save far more than could be saved by any other efficiency policy at low costs to consumers and society. Energy labels are also a critical element of an energy efficiency policy strategy as they provide the otherwise missing information on equipment energy use that is needed to allow demand and supply side options to compete in a level marketplace.

Examples of actual monitoring and verification of the added cost that consumers pay as a result of standards are hard to find. The most rigorous example that we have found is a retrospective evaluation of the features and energy consumption of refrigerators in the U.S. prior to 1990 standards and after imposition of 1990 and 1993 standards. The assessment concluded that "consumers appear to have received higher levels of cold food storage service at lower operating costs, without significant increases in purchase, or 'first,' costs" (Greening et al. 1996). Because structural changes in the appliance market accompanied the introduction of U.S. refrigerator labels and standards, a rigorous researcher cannot conclusively attribute the benefits to the standards. However, researchers are generally confident that a valid evaluation of the exact impact of U.S. refrigerator standards, if that were possible, would show lower costs and similar benefits accruing from the labels and standards than those reported above.

2.6 Steps in Developing Energy-Efficiency Labels and Standards Programs

Typical steps in the process of developing energy-efficiency labels and standards for consumer products are defined below. These steps are shown schematically in Figure 2-8, described briefly in the following paragraphs, and discussed in depth in subsequent chapters.

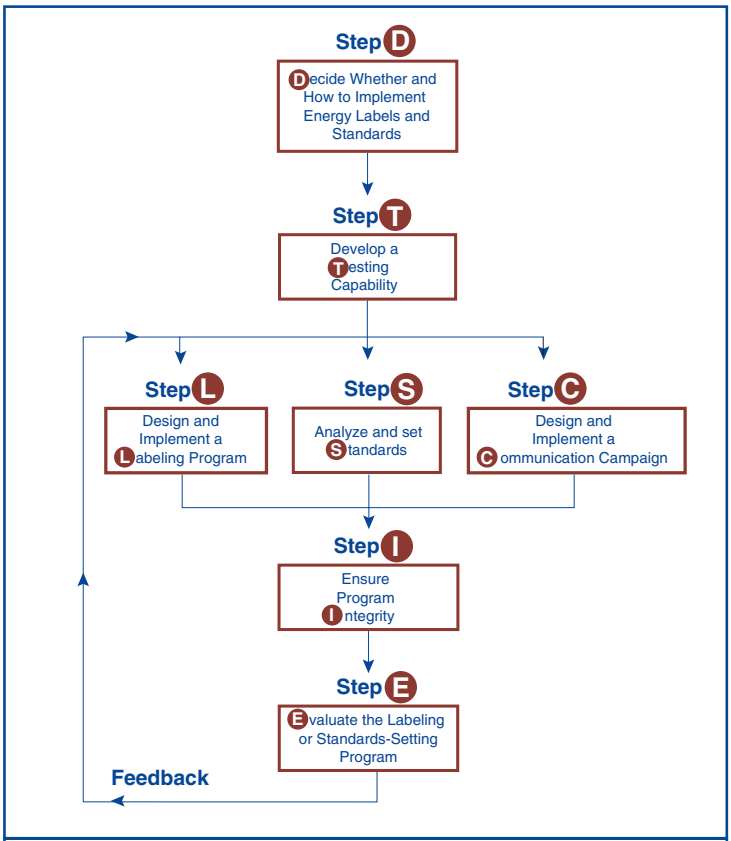


Figure 2-8 Typical steps in the process of developing consumer product energy-efficiency labels and standards

2.6.1 First Step D: Decide Whether and How to Implement Energy Efficient Labels and Standards

A government's decision on whether or not to develop an energy-efficiency labeling or standards-setting program is complex and difficult. Many actors and factors determine whether such a program is beneficial in any particular country. Chances for success are best if the process of making the decision and preparing to establish a labeling or standards program includes:

- assessing how local cultural, institutional, and political factors are likely to influence the adoption and effectiveness of the program
- establishing strong and clear political legitimacy for standards
- deciding the extent to which to rely on existing test facilities, test procedures, label design, and standards already established by international organizations or neighboring countries
- assessing the data needs of the program and the capability of the government to acquire and manage the data
- screening and selecting which types of products are the highest priorities

These basic elements in the preparation for a labeling or standards-setting program are described in Chapter 3. Some key aspects of the process are described below.

Assessing the Capacity to Develop and Implement a Program

Appropriate constitutional, legislative, and administrative authority must exist or be established for conducting each of the steps of the standards-setting process. Sometimes the decisions to implement energy-efficiency labels and standards and to cover particular products are made by legislation. Otherwise, these decisions must be formally made by the implementing agency. It is best if the steps and schedule for establishing energy-efficiency comparison labels and standards are clearly prescribed in enabling legislation or rule making. Endorsement and other voluntary labeling programs may not require regulatory formality but should still be set up as transparent processes with clear and logical steps and procedures. In all cases, trained, competent personnel must be available and institutions must exist to effect change. A testing capability must exist or be established. Resources must be allocated. The potential impact on local manufacturers must be understood and be acceptable. And the appropriate political will must exist or be reasonably achievable.

Once the decision has been made to adopt energy-efficiency labeling requirements and standards, the implementing agency must establish rules for all the subsequent steps in the process, that is, for analysis, public input, compliance testing, certification, marketing and promotion, enforcement, monitoring, and revision. This is a time-consuming venture that evolves over the years as the initial strategy is refined.

Serious consideration should be given to aligning or harmonizing elements of the labeling or standards-setting program to match those of a country's trading partners. Alignment or harmonization

allows countries, companies, and consumers to avoid the costs of duplicative testing and non-comparable performance information while also benefiting from a reduction in non-tariff trade barriers and access to a wider market of goods. As mentioned previously, appropriate harmonization can avoid the "least common denominator" approach that holds all of the participating countries to the levels that are acceptable to the least progressive country. It can also avoid undue complexity and delays in the process of establishing standards and labels. Australia has used this approach as described in insert: *Australia Aligns With the World's Best Practice*. Recognizing the potential benefits, many countries are participating in regional activities directed at harmonizing energy-efficiency standards and labels and especially the testing that underlies both these measures.

Assessing Data Needs and Screening/Selecting Products

Before deciding to implement energy standards in a country, it is important to estimate the potential impact of the standards by quantifying their predicted environmental and

Australia Aligns With the World's Best Practice

Initially, the Australian scheme, copied from North America and Europe, focused on domestic debates between Australian-based stakeholders about labeling options. Through the 1990s, the program stalled (withmandatory labels applied to only six major appliance types). The lower-than-expected impact of the scheme was attributed to continuing market failures though this focus on domestic solutions was also eventually identified as an impediment.

In 1999, the Australian scheme shifted focus to match the most stringent energy performance requirements mandated by Australia's trading partners. This move to expand the focus to "world best regulatory practice" was a direct response to program experience and overcame many of the problems of a domestically focused program. The "best regulatory practice" policy authorizes Australian government officials to regularly review energy-efficiency standards in force around the world to benchmark energy performance of appliances and equipment. It also systematically expands the products covered by regulated standards in Australia. By relying on standards developed by trading partners, the Australian government and local manufacturers avoid the significant costs of conducting technical and feasibility analyses to justify efficiency regulation of appliances and equipment and avert the arguments about trade barriers and technical feasibility of the proposed standards that so often delay standards in other countries.

The change proved to be successful in releasing cost-effective energy efficiency benefits in the Australian economy. The program is now a partnership between government and industry examining cost effective options to improve end-use product energy efficiency rather than divisive debates about what is or is not possible. It regulates 16 product types and has announced plans to cover up to 50 product types by 2010. The Australian approach benefits local consumers because, if a major trading partner has banned the sale of products on inefficiency grounds, those same products cannot be "dumped" in Australia. Australian manufacturers support the scheme because, if a product is made in Australia meeting this policy, it can be exported to any market throughout the world. The Australian environment benefits from cost-effective energy conservation and greenhouse gas emissions abatement.

monetary benefits. Much information on this process is available from existing label and standards programs around the world. Some information is provided in this guidebook, and much more is available from the referenced resources. Ideally, assessment of the technical potential of labels and standards will be based on data collected on the use of consumer products that describe:

- current levels and forecasted trends for efficiency of products in the marketplace
- specific new technology that has recently or will soon become available in the marketplace
- existence and characteristics of domestically manufactured products
- existence and characteristics of imported products
- existence and levels of standards in other countries

This assessment will usually involve collecting and interpreting new local data. This process and the evaluation of how much of the technical potential can be achieved and how much it will cost are described in Chapter 3.

Deciding which products should be covered by standards depends on a number of factors. Implementing labels or standards for different consumer products, such as refrigerators, freezers, room air conditioners, lamps, and fluorescent lamp ballasts, will involve different costs and yield different benefits. The opportunity also exists for addressing one specific energy use in most or all appliances with a single regulation, as in the case of limiting standby power losses (IEA 2002). In addition to analyzing the impact of and resources needed to implement a given standard, choosing a standard also may require assessing the reality and the politics of the manufacturers' market, the government's ability to enforce the standards, and other factors. It is important for program credibility and success that energy-efficiency labeling and standards programs be established and applied to a product only when the necessary resources are likely to be available.

2.6.2 Second Step T : Develop a Testing Capability

A uniform product-testing procedure for each major appliance is a vital precursor to the development of a label or standard for that product. All manufacturers' products must be evaluated in the same way. This requires, for each type of product, a standard metric [e.g., kilowatt-hours (kWh) per year, coefficient of performance (COP), seasonal energy-efficiency rating (SEER), efficacy factor], a standard test facility, a standard test procedure, and a process for assuring compliance with testing requirements, as described in Chapter 4.

Testing capabilities can be created in a testing center within the country, shared among several countries, or purchased from outside the country. In some countries where most or all of the units of a particular appliance are imported from foreign manufacturers, it may be cost effective to rely on existing test facilities from the country of origin. Assistance is often available to help plan and design the necessary test facility (see Section 2.8).

Testing by manufacturers and private laboratories must be accredited and recognized. Generally, government costs are reduced and product marketing delays are avoided if governments rely mainly on private testing and only conduct audits themselves.

Adoption of existing test protocols for assessing product energy efficiency is strongly preferable to creation of a new protocol. Existing protocols have the advantage of being known quantities. Repeatability and reproducibility are established, and the facility needs and benefits and issues associated with existing protocols are already well defined, whereas new protocols pose the risk of new, unforeseen issues. In addition, there is great benefit to manufacturers and all affected parties if a test protocol is harmonized at the highest possible level—preferably globally, or at least among regional areas of trade. Harmonization allows for consistent decision criteria and standardization among all models, which, in turn, allows for economy of scale in manufacturing. Investments in energy-testing facilities and test resources are also minimized. Interest and participation in alignment with trading partners, regional harmonization collaborations, and international standards organization specifications have been expanding rapidly in recent years.

2.6.3 Third L and Fourth S Steps: Design and Implement a Labeling Program and Analyze and Set Standards

Label Design

The goal of an energy-labeling program should be to encourage consumer awareness and choice in the purchase of an energy-using product or appliance and thus shift the market toward greater energy efficiency. From a consumer's perspective, the energy label is the most important and obvious element of the program. However, the label that appears on a product is only a small part of an elaborate infrastructure. The design of a labeling program involves several key choices:

- What products should be covered?
- Should a program start with endorsement or comparative labeling?
- How, and to what degree, should endorsement and comparative labels be linked?
- If a comparative labeling program is chosen, should it be mandatory or voluntary?
- Should comparative labels be continuous or categorical?

After these choices are made, label requirements can be established in a variety of ways, usually involving consumer research (e.g., use of focus groups) as an important element. Label designers typically face the choice of whether to focus on accommodating current consumer response to achieve short-term impact or striving for long-term changes in consumer understanding and behavior. This choice is addressed in more detail in Chapter 7, and all aspects of designing labels are addressed in Chapter 5 where examples of several types of labels are described.

After a labeling program has been designed, coordination with the testing program is required to ensure that the information presented on the label is accurate. Then the label design can be finalized and the program implemented.

Consideration should be given to regional labeling if the marketplace, particularly for imported products, is more regional than national. Even slightly different labeling requirements among nations can be disruptive to trade, limit choices, and add to consumer costs. Harmonization of labels needs to be considered in two parts: harmonization of the technical foundation (i.e., shared metrics and technical categorization) and harmonization of label format and presentation. There are good reasons for harmonizing the former as broadly as possible as long as this doesn't significantly restrain the more progressive participants in the collaboration or bog down the process in bureaucratic red tape. Harmonizing label design can be beneficial but may have limitations if cultural differences among participating countries would render a single label design ineffective. In such situations, customized label designs may be preferable.

Standards-Setting

A standard can be set to:

- eliminate inefficient models currently on the market
- avoid import of inefficient products
- encourage importers and local manufacturers to develop more economically efficient products

Several types of analyses should be conducted to ensure that a standard achieves its purpose. Following is a listing of the types of analyses that have been used and are based on existing methodologies for determining the level at which to set a standard. These methods are described in detail in Chapter 6. The resources that any country devotes to these analyses should be carefully tailored to the country's specific situation. Sometimes simplified analyses can be conducted or analytical results adapted from other countries. Each country needs to customize existing data and analytical models to fit its own needs, train government staff or others to perform the analysis, and review the analysis to verify results.

Engineering Analysis—An Engineering Analysis assesses the energy performance of products currently being purchased in the country and establishes the technical feasibility and cost of each technology option that might improve a product's energy efficiency as well as evaluating each option's impact on overall product performance.

Market Analysis—A Market Analysis is an alternative to an engineering analysis. It looks at the existing efficiency or energy consumption choices for a product of a given size available in the regional or national market and compares the difference in cost for each choice with the difference in energy use. This method may be used when it is difficult to perform engineering analysis or when it would be

helpful to corroborate the results of the engineering analysis. This method generally (but not always) produces less ambitious energy-efficiency targets than an engineering analysis will because some cost-effective technologies may not yet be incorporated into existing products.

National Impact Analysis—A National Impact Analysis assesses:

- the societal costs and benefits of any proposed standard
- the impacts on gas and electric utilities and future gas and electricity prices that would result from reduced energy consumption
- the environmental effects—e.g., changes of emissions of pollutants such as carbon dioxide, sulfur oxides, and nitrogen oxides – that would result in residential and commercial buildings and power plants because of the reduced energy consumption

Consumer Analysis—Consumer Analysis determines the economic impacts on individual consumers of a standard, including effects on purchase and operating costs.

Manufacturing Analysis—A Manufacturing Analysis predicts the impact of a standard on international and domestic manufacturers and their suppliers and importers. This analysis assesses effects on profitability, growth, and competitiveness of the industry and predicts changes in employment. Depending on the local situation, this analysis may be expanded to include distributors and retailers.

The earlier recommendation to standardize test protocols does not necessarily extend to energy standards levels. Standards levels should be assessed based on specific national situations and should integrate factors such as user habits, the use environment (including power distribution characteristics), the technological and financial situations of affected manufacturers, the approaches adopted by trading partners, and the estimated impact on the national economy. An example of a reason to differentiate standards based on country-specific conditions is evident in the higher-efficiency motor designs typically applied in developed countries, which may not be appropriate with the higher-variability power distribution networks typically found in developing countries.

Stakeholder and Consumer Involvement

The initial recommendation of a label design or standard for any consumer product should begin a process of public review and revision. The need for standards is based on the premise that an improvement in the energy efficiency of products will serve the overall public good. Manufacturers want to ensure that standards will not require large, unjustified capital investments and do not limit product utility or features or consumer choice. Energy-efficiency and environmental advocates generally want manufacturers to make products that are as efficient as technically possible. The government's role is to determine the optimum public good using information that is often incomplete and claims that are sometimes contradictory. The more input the government collects from all involved stakeholders, the more informed its decisions will be.

A beginning standards level is best set based on a compilation and examination of the results of various analyses, tempered by technical and political judgment, which leads to a recommendation that maximizes the long-term public good. In the early stages of the process, there should be as much reliance on the results of the analysis and as little political judgment as possible (no matter which interested stakeholders apply pressure). The analysis keeps the ultimate political recommendation within realistic bounds. The more the level of a standard remains grounded in a thorough, objective technical and economic analysis, the greater its political sustainability and the degree of compliance with it. Thorough, objective analysis requires an equitable balance of input from the various interest groups.

Legislators or government officials responsible for establishing labels and standards programs in a country must specify what level of public involvement is most appropriate for that country. Experience to date shows that the more manufacturers, consumer organizations, and other interested stakeholders are involved early in the label-design or standards-setting process, the more effective the resulting labels and standards (i.e., they lead to greater economic efficiency, more product model options, and more appropriate applications of technology) and the greater the rate of compliance by affected manufacturers. Whether the goal is to refine the design of an energy-efficiency label or the level mandated by an energy-efficiency standard, testing the response of the users of the labels and stakeholders affected by the standards early in the process is extremely useful to enhance the quality of the outcome. In many developing countries, there is little experience with providing public notice, conducting focus groups and public hearings, interpreting public comments and reviewing and weighing their relevance, and making appropriate changes to balance the expressed interests of many stakeholders. The experience of other countries that are practiced in collecting, acknowledging, and seriously considering public input is sometimes transferable, depending on the democratic tradition and governance style of each country. Assistance is often available for these efforts.

Promulgation

The steps and schedule for establishing energy-efficiency labels and standards are most often clearly prescribed and straightforward in enabling legislation or rule making. Specifying the information requirements and format for labels, the level for standards, and the schedule for both can be politically sensitive, however, and politically induced delays are common. Often, manufacturers and their suppliers and distributors practically or philosophically oppose this type of government regulation. Manufacturers must have time to create labels, retool, make and distribute new models, and dispose of old inventory. They will often want a longer transition period than government regulators would choose. The interests of other stakeholders may bring pressure for additional analysis and greater efficiency levels.

Government officials responsible for promulgating labeling requirements and standards must find an appropriate balance between consensus-building and unilateral government action. They should be open, transparent, and flexible in balancing the variety of considerations entailed in deciding whether

and what labeling and standard regime to adopt and how rapidly the regime should be implemented. No matter how much they rely on consensus-building, they must be prepared to withstand strong political pressure and maintain a regulatory posture with focus on what is best for the country in the long term. More information on this subject is provided in Chapter 5 for labeling and Chapter 6 for standards-setting.

2.6.4 Fifth Step C: Design and Implement a Communication Campaign

Effective standards-setting and labeling programs require a communications campaign to support acceptance and use of the new standards and/or labels. Consumers and retailers need encouragement and stimulation to change their behavior. Experience shows that programs will be more effective if they adopt targeted messages and communications mechanisms. Execution of an information campaign is a significant undertaking that involves designing information channels, creating evaluation tools, pre-testing all the elements of the campaign, and continuously evaluating and refining the campaign based on consumer response.

2.6.5 Sixth Step I: Ensure Program Integrity

After the label design process is mandated or a standard is set, those responsible for the labeling and standards-setting programs must monitor and enforce compliance based on a foundation of accurate and reliable information. Both a well-thought-out and well-implemented verification regime (to determine whether the declared energy performance of equipment available on the market is accurate) and compliance regime (to ensure that market actors abide by the requirements of the program) are needed to ensure the program's integrity. Accrediting testing facilities and certifying test results are important components of verification.

The government officials responsible for labels or standards must be prepared to assess the potential effectiveness of self-certification and other certification processes; establish certification and compliance monitoring procedures; and train personnel in certification procedures, compliance monitoring, and enforcement programs. Officials must also be ready to defend their actions if challenged in courts as has happened in some countries.

Aside from legal issues of compliance and enforcement, there is the practical issue of helping people acclimate to a marketplace that requires manufacturers to provide information labels on products and to manufacture and market products that meet or exceed a specified efficiency level and/or encourages them to participate in endorsement labeling programs. This takes time, and providing information and training at various points in the product chain can significantly shorten the length of time. In fact, the viability of a labels or standards program can be jeopardized without appropriate public education and training. In some countries, the involvement of environmental advocacy organizations is also important. A well-designed labels and standards program includes training programs in product engineering or

regulatory compliance for manufacturers, label interpretation for product salespersons and consumers, label and standards design for implementing agency officials, and public involvement for stakeholders. Likewise, a public education campaign to educate consumers and retail staff about what labels mean and how to use them, as described in Chapter 7, can be crucial to the success of a program.

All these elements of verification and compliance for labeling and standards-setting programs are addressed in Chapter 8.

2.6.6 Seventh Step E: Evaluate the Labeling or Standards-Setting Program

If a government is to maintain an energy-efficiency labels and standards program over the long run, it will have to monitor the program's performance to gather information to guide adaptations to changing circumstances and to clearly demonstrate to funding agencies and the public that the expected benefits are actually being achieved. Good test procedures, labels, and standards require periodic review and update. Periodic review allows the government to adjust test procedures, redesign labels, and adjust or "ratchet" the stringency of standards upward as new technology emerges and use patterns change. Review cycles in countries with labels and standards programs typically range from three to 12 years, depending on the product and national priorities.

As described in Chapter 9, establishing a monitoring program includes planning the evaluation and setting objectives, collecting data, analyzing the data, and applying the evaluation results, where appropriate, to meet several goals. These goals include refining the design, implementation, and evaluation of the labeling and standards-setting programs; supporting other energy programs and policies; and supporting accurate forecasting of energy demand for strategic planning. The analysis will normally include assessments of the actual energy consumption of the regulated products, the level of consumer satisfaction with new energy-efficient models, and the impact of the program on individual manufacturers and their industry. It is important for the labeling and standards-setting program to allocate resources and perform this task in a systematic and meaningful way.

In addition, labeling and standards-setting agencies are usually obligated to report the results of their activities. Generally, this merely entails compilation of the results of all the activity described above. Only if the monitoring program is underfunded is there likely to be any difficulty in achieving this task.

2.7 Relationship to Other Energy Programs and Policies

Energy-efficiency labels and standards work best in conjunction with other policy instruments designed to shift the market toward greater energy efficiency. Standards typically eliminate the least efficient models from the market. Other energy policies and programs, including energy-efficiency labeling, help to further shift the market toward higher energy efficiency. No one government policy makes an energy-

efficient economy. Together, an array of policy instruments can influence manufacturing, supply, distribution, product purchases, and the installation, operation and maintenance of energy-consuming products. When working effectively, these policy instruments accelerate the penetration of energy-efficient technology throughout the market. A rich portfolio of policies is necessary to achieve the stated economic and environmental goals of most of the world's nations.

Although energy-efficiency labels and standards are considered by many to be the backbone of a country's program for efficient residential and office energy consumption, the overall energy-efficiency package should also include complementary programs, such as:

- research and development
- energy pricing and metering
- incentives and financing
- regulation, in addition to information labels and standards
- voluntary activities, including quality marks, targets, and promotion campaigns
- energy-efficient government purchasing
- energy auditing and retrofitting
- consumer education

An important trend in some countries is to combine policy instruments in ways that selectively support "market transformation"; this results in specific interventions for a limited period that lead to a permanent shift toward greater energy efficiency in the market. Chapter 10 discusses how labels and standards fit within a larger portfolio of energy-efficiency policies and programs and how best to combine and sequence policies to create an effective, sustainable market-transformation process

2.8 Availability of Technical Assistance

Need help? Whether you're looking for technical expertise or financial assistance, help is often available through bilateral and multilateral grants and loans for such activities as:

- assessing the potential benefits and costs of labels and standards
- establishing appropriate legal frameworks for labels and standards
- adopting test procedures, laboratory services, and labeling schemes
- setting cost-effective standards based on various analytical methodologies
- monitoring and reporting on labels and standards
- evaluating the impact of labels and standards

- participating in regional forums on harmonization of elements of labeling and standards-setting programs
- training government officials; utility company employees; product manufacturers, distributors, and salespeople; architects/designers; environmental activists; and/or consumers in any aspect of the design, development, implementation, and use of energy-efficiency labels and standards

Several organizations have grant programs that offer technical expertise to developing countries specifically for creating energy-efficiency labeling and standards programs. The most prominent of these are listed below; there are many more, however, especially in European countries:

- The United States Agency for International Development (U.S. AID), which offers training and technical assistance for energy-efficiency labeling and standards programs for most countries (U.S. AID funded much of the preparation of this guidebook).
- The United Nations Department of Economic and Social Affairs (UN/DESA), which has been helping six Arab countries with energy standards, implementing a refrigerator efficiency project in China, and offering assistance through a grant from the United Nations Foundation (UNF) to assist all aspects of energy-efficiency labeling and standards programs worldwide.
- The United Nations Economic Commission for Latin America and the Caribbean (UN/ECLAC), which is working with several Latin American countries using a parliamentary approach to enact legal and regulatory reform for energy standards.
- The United Nations Economic and Social Commission for Asia and the Pacific (UN/ESCAP), which has organized workshops in numerous Asian countries to promote energy standards.
- The United Nations Economic Commission for Europe (UN/ECE), which promotes standards under its Energy Efficiency 2000 program and manages some European Commission programs in Eastern Europe.
- The Global Environmental Facility (GEF), administered through the World Bank, the United Nations Development Program (UNDP), and the United Nations Environmental Program (UNEP), which provides grants for greenhouse gas mitigation. For example, GEF has contributed $9.8 million to a $40-million program to improve the efficiency of refrigerators in China, including the development of stringent energy-efficiency standards.
- UNDP—See GEF entry above.
- UNEP—See GEF entry above.
- The European Commission's Directorate General for Transport and Energy (DG TREN), which sponsors projects to promote energy-efficiency programs, including labeling and transformation of the appliance market in European countries outside the E.U. It also has programs to foster collaboration on energy efficiency with Latin America and Asia.
- The IEA, which conducts regional workshops and prepares publications to promote energy-efficiency standards and labels in non-IEA countries.

- The Energy Foundation, whose mission includes assisting China's transition to a sustainable energy future by promoting energy efficiency and renewable energy.
- UNF, which has an environmental component in its charter and has provided direct grants for the development of standards-setting and labeling programs globally, most recently targeting China, India, and Brazil.

In addition to grant programs, multilateral banks are increasingly recognizing that energy-efficiency labels and standards are cost effective for governments and as a result have been providing loans to fund elements of the development of these programs. At this point, we are aware of loans of this type given by the Asian Development Bank (ADB), the Interamerican Development Bank (IDB), and the International Bank for Reconstruction and Development (World Bank).

Many other organizations worldwide are involved in the various aspects of developing labeling and standards-setting programs. These organizations include manufacturers' associations, standards-setting organizations, testing laboratories, government agencies, lending institutions, consultants, universities, and public-interest advocacy groups. More information is given about these organizations in the specific chapters that follow.

CLASP, a global partnership formed in 1999 with the sole mission of fostering energy efficiency labels and standards worldwide, provides technical assistance on request and extensive information about labeling and standards-setting programs, including current information about resources available for supporting such programs, at its website (www.clasponline.org).