3. Deciding Whether and How to Implement Energy-Efficiency Labels and Standards

Guidebook Prescriptions for Deciding About Labels and Standards

1. **Review existing legislation and establish framework legislation to develop a legal basis for and political commitment to labels and standards.**
2. **Assess existing institutional capacity for developing, implementing, and maintaining a labeling and standards-setting program.**
3. **Develop an overall label and standards-setting plan, and assign one government agency primary responsibility for driving each element of the program. Consider starting with a voluntary program.**
4. **Harmonize energy-performance test procedures with international protocols to facilitate testing and reduce barriers to trade.**
5. **Establish minimum data needs, and develop a plan for collecting the data necessary to conduct analysis to support the program. It is better to rely on simple forecasts based on limited but reliable data than on detailed forecasts from end-use models that are based on unreliable proxy data. If you need more data to decide whether or not to proceed, take the time to collect it.**
6. **Use cost-effectiveness analysis to screen the products to be included in the program and establish the order of priority.**
7. **Plan to periodically review and update the labels and standards every few years.**

This chapter introduces the complexities of deciding whether or not to develop an energy-efficiency labeling or standards-setting program. **Figure 3-1** illustrates a five-step process for deciding whether and how to implement a labeling and standards-setting program. The following sections address each of these steps.

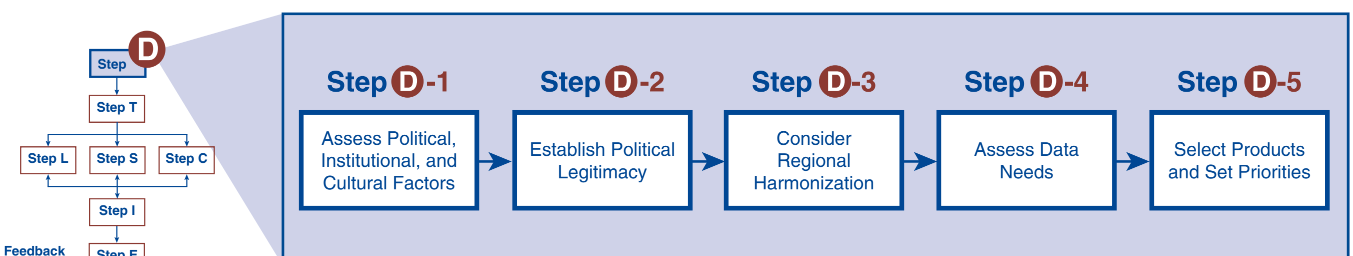


Figure 3-1 Major steps in deciding whether and how to implement an energy-labeling or standards-setting program

3.1 Step D-1: Assess Political, Institutional, and Cultural Factors

The first step in deciding whether or not to develop an energy-efficiency labeling or a standards-setting program is to assess how local political, institutional, and cultural factors are likely to influence the adoption and effectiveness of the program. For example, in countries that have a tradition of strong central government, it may be relatively easy to reach political consensus that a sweeping set of minimum standards will provide consumer benefits that are not being captured by the private market. In countries with a less centralized political structure, there may be greater resistance from influential stakeholders (i.e., manufacturers and distributors) to mandatory regulations, and time and education may be required to convince concerned parties to accept the benefits claimed for energy-efficiency standards. A substantial amount of education and persuasion may also be required to convince key stakeholders that standards are economically beneficial to consumers, do not decrease consumers' choice of products, and do not reduce the number of consumers who can afford quality-of-life improvements such as air conditioners.

International experience to date has shown that, in the case of energy labeling, cultural differences are often not as important as cultural similarities, and much of what works in one region is often transferable to another (as described in Chapter 5). In all cases where a country decides to proceed with labels or standards, it is important to develop support for labeling and standards-setting programs—not only within the government but in the private and non-governmental organization (NGO) sectors as well. In addition, impartial and credible labeling and standards-setting institutions need to be in place to ensure effective results. These institutions need to have a mandate, an adequate budget, and enough staff to effectively oversee the development and implementation of the programs.

Potential implementers of standards and labeling programs can consider that these programs require both legal authority and institutional resources. These requirements are addressed in the following two subsections.

3.1.1 Assessing Existing Energy Regulatory Frameworks

It is *always* important to begin assessing a labeling and standards program by examining the existing regulatory framework to determine what authority the government has to establish such a program. It is true that legislation may not be a prerequisite for the development of labeling and standards-setting programs and that a voluntary program may be less politically risky to undertake without a legislative mandate than a mandatory program would be. Nonetheless, direct legislative support or some form of legally mandated authority for the implementing agency greatly enhances the likelihood that a labeling or standards-setting program will be adopted and have a significant and sustained impact over time. The stronger the implementing agency's claim to legal jurisdiction, the more likely the program will survive adversarial challenges.

The first questions to ask are:

- Is there legislation that affects the energy performance of products?
- Is any agency empowered to establish minimum energy-efficiency standards or a mandatory energy-labeling program?
- Is there a standards agency that regulates the quality and performance of products, including products that consume energy?
- Is any agency empowered to develop energy-performance test procedures for energy-consuming products?
- Is there any existing legislation to protect consumers against false product-performance claims?

These questions must be answered early because legislation forms the basis of an effective mandatory program. Even when voluntary agreements are reached with industry, these agreements are often only achieved when industry perceives that government negotiators may enforce a mandatory scheme instead. This has been the case in negotiations to develop voluntary appliance energy-efficiency targets in Switzerland, Japan, and the E.U. Legislation should provide a clear, legal mandate for a government agency to require manufacturers (or retailers) to test products in a uniform way and place labels on all affected products. The passage of legislation also signals strong political support for the program. For voluntary programs, especially those aimed at stimulating voluntary actions by consumers, legislation may be less important.

The most widely practiced approach for developing legal authority for labels or standards has two stages. First, general "framework" *legislation* is introduced. This legislation may authorize an agency to implement standards and/or labels; it may mandate such programs; it may prescribe what products are to be addressed in the programs; and/or it may even prescribe initial standards. The establishment of this legislation is followed by promulgation, by an implementing agency, of *regulations* tailored to specific product types (e.g., lamps, refrigerators). (See discussion of framework legislation in Section 3.2.2.)

3.1.2 Assessing Existing Institutional Capacity

Early in the process of assessing local cultural and political factors, it is important to evaluate the existing resources and institutional capacity for developing, implementing, and maintaining labeling and standards-setting programs. In particular, these programs require financial resources, personnel, and physical facilities.

Financial Resources

A regular and consistent source of funding for an operational budget is required, from one source or a combination of sources. Typically, annual government budget allocations are the most reliable although they can be difficult to justify and obtain at the outset of a program. Some countries supplement governmental resources with fees collected from manufacturers for testing, certification, and/or the label itself. For example, China's endorsement label is supported in part through a certification fee collected from manufacturers on a voluntary basis in exchange for use of the endorsement. India is considering a fee for information labeling to support its program, which will pilot as a voluntary program and switch to a mandatory initiative within five years. Many developing countries rely, at least initially, on donor funding to support the launch and/or implementation of programs. These funds can be an essential source of revenue, but, over the mid to long term, a self-sustaining alternative must be developed to ensure program continuity in the face of diminishing donor assistance.

Personnel

Qualified staff are needed for testing, technical analysis, administration, monitoring, enforcement, evaluation, and information campaigns. Some outsourcing is possible and even desirable but, in general, base program management will require a dedicated staff that develops niche expertise in standards-setting and labeling programs.

Energy-performance testing is the first staff capability that must be in place. As described in Chapter 4, this requires specialized expertise. Technically specialized staff are also required to analyze energy efficiency, set standards, and design labels, as described in Chapters 5 and 6. Conducting the communication campaigns described in Chapter 7 takes a different kind of talent. The same is true for the monitoring of certification and compliance described in Chapter 8. The evaluators described in Chapter 9 should also be trained experts capable of objective program review and are, ideally, independent of the implementing agency. This specialized work can be done in house or contracted out to trained independent experts. The enforcing institution must have an adequate budget to hire staff or engage consultants to carry out its task. One possible problem in developing countries is that civil service regulations and pay scales may make it difficult for government testing and enforcement agencies to attract and maintain high-quality staff.

The institutional review that precedes the establishment of a program should evaluate whether the agency responsible for enforcement has the personnel and resources to operate effectively. The review should also specify roles for appropriate institutions, identify areas that need strengthening, and evaluate the tasks that must be carried out to build the necessary capacity in all key institutions. The review will help to establish the existence of any major practical constraints that might limit program development. The review should also give an early indication of the program's viability, taking into account the likely resources and depth of political support.

Especially in smaller countries, it may be an inefficient use of limited financial, technical, and human resources for each nation to develop separate institutional capacity for labeling and standards. Consideration should be given to regional approaches or to relying on programs in other geographical areas that affect the local appliance market.

Facilities

The type and location of facilities will vary depending on the particular program but will include some combination of central offices for dedicated staff, field facilities for monitoring/enforcement, and/or laboratories for testing. The establishment of fully equipped, staffed, and accredited test laboratories, the subject of Chapter 4, can be the most resource-intensive and time-consuming aspect of developing a labeling and standards-setting program. Test laboratories are expensive to construct and operate, and it is not generally practical for them to be sustained solely for the purpose of supporting an energy-labeling and standards-setting program.

The lack of availability of testing laboratories or of funds for their development has often been a serious barrier to the development of standards-setting or labeling programs, especially in the least economically developed countries because many sources of foreign aid preclude the use of assistance funds for laboratory construction and because these countries often suffer from limited foreign exchange. If no suitable test laboratories are already in place within a country, it may be necessary to consider establishing energy-efficiency testing as part of wider government programs covering product safety, quality, and environmental acceptability. Alternatively, policy makers may consider pooling resources with neighboring countries to establish a regionally funded and managed test laboratory. Another option may be to rely on existing private-sector test laboratories. Care must be taken, however, to avoid potential conflicts of interest. For example, it may not be appropriate for test laboratories that are doing research for regulated companies on a contract basis to also act as program-designated test centers.

A country should assure itself that it has adequate resources—including an ongoing budget for operation and maintenance—for the facilities it needs before undertaking a major standards and labeling program.

3.2 Step D-2: Establish Political Legitimacy

Mandatory labels and standards can have an inherently adversarial aspect because they force manufacturers to take action that they might not otherwise take. Minimum energy-efficiency standards, for example, compel the appliance and equipment industry to make capital investments to design, manufacture, and market more efficient products than they otherwise might. If such potential conflicts are not dealt with early in a program's design, they may prove detrimental to its operation. It is, therefore, important to establish strong, clear political legitimacy for standards as early as possible. This is the second step in deciding whether or not to develop labeling and standards-setting programs.

Political legitimacy can take various forms, depending on the nature of the government or other agencies involved. Legitimacy is strongest when a program is widely recognized as reflecting a social consensus that is supported by top political leaders and articulated in binding legislation or decrees. Whatever the form of expression, political authorities should establish a clear sense of the:

- strength of their political resolve
- objectives of the program
- lines of program authority

- boundaries for program intervention
- need for an open and transparent process for program design
- relationships with other relevant energy and non-energy policies

3.2.1 Determining Boundaries of Authority and Responsibility

For the sake of program effectiveness and economies of scale, governments may wish to enact labels or standards in as large a market as possible. However, product markets often do not match political boundaries. This issue can be especially complex in federated states as the federal government may or may not have sufficient authority to regulate all types of commerce within its states or provinces. Below we briefly summarize the process of legislating labeling and standards-setting in countries that are federations of states or provinces: Canada, Australia, the E.U., and the U.S.

In Canada, federal jurisdiction over energy is limited to international and inter-provincial commerce. Thus, federal standards apply only to products imported into Canada and/or shipped between provinces but not to products manufactured and sold within a single province. Given the nature of the Canadian appliance and equipment market, federal jurisdiction is sufficient for an effective standards program; standards apply to the vast majority of products sold in Canada.

In Australia, individual states and territories are responsible for legislation, regulation, and associated administration. State-based legislation is necessary because the Australian constitution gives the states clear responsibility for managing resources, including energy. Thus, the federal government has taken on the job of coordination. Federal authorities assist in writing "model" legislation that the states and territories then "mirror."

In the E.U., each national government is obliged to coordinate with the union to prevent the creation of non-tariff trade barriers when developing a policy. This situation may soon be repeated in other trade blocks as provisions about minimizing barriers to trade are becoming increasingly common.

In the U.S., national regulations have, for most products, superseded those enacted by individual states. In the mid-to-late 1980s, U.S. manufacturers pushed for uniform regulation throughout the country so that they would not be forced to offer different product lines in different states. Some economists have suggested that federal regulations are more economically efficient.

3.2.2 Enacting Framework Legislation or Decrees

Political authority for mandatory standards and labels should be built on a strong but flexible foundation. In most countries, this means enacting a framework law or issuing a decree that mandates standards and/or labels for certain products, with provisions for expanding and revising the program later (European Community 1992). Framework legislation should be generic and comprehensive rather than piecemeal, creating a legal basis and authority for developing labels and/or standards without specifying technical details related to specific products. In occasional cases, for example where there is a solid but possibly fleeting political consensus in support of standards, it may be advisable to act quickly and out-line only the very basic framework of the program in the law itself, leaving all the technical details to a capable regulatory body. This approach was used in Mexico in 1991 and more recently in China and India. In other cases, for example where the political consensus is weak, it may be advisable to write technical details into the law to make the regulation more powerful and enduring. This was the approach used in the U.S., where general regulatory authority for the U.S. Department of Energy (U.S. DOE) was augmented by initial standards levels and effective dates that were specified by the U.S. Congress for some products; this is an example of the legislative branch driving a less-committed executive branch. Generally, the preferable strategy is to develop a generic framework that empowers a capable agency to develop the technical details.

By empowering an implementing agency to develop product-specific regulations at a later date, framework legislation avoids the need to return to the legislative assembly to seek approval for each new regulation. This approach passes responsibility for developing product-specific legislation to a body with technical competence and removes a potentially significant cause of delays that could greatly reduce program effectiveness. Framework legislation should identify the main stakeholders and define their roles, responsibilities, and obligations related to the law. It should also designate a government agency as the "implementing agency" and give this agency the authority to issue product-specific minimum efficiency standards (see insert: *Examples of Framework Legislation*).

Optimal framework legislation or decrees describes:

- defined program objectives
- authorized types of intervention (mandatory standards and/or voluntary targets)
- criteria for determining which products are covered
- criteria for the level of technical intervention (based on consumer payback time, life-cycle costing criteria, or harmonization with trading partners)
- an implementation time frame
- process rules and deadlines
- a requirement for an evaluation report on the program's impact, including effects on manufacturers, consumers, and the nation

In practice, the amount of technical detail (e.g., product categories, standards levels, implementation dates, revision schedule) specified in a law or decree is likely to be a matter of political strategy. Provisions such as the U.S. prohibition on standards that significantly impair product selection, product function, or national commerce may be necessary to reassure concerned stakeholders and develop a political coalition in support of the legislation.

Examples of Framework Legislation

Two good examples of framework legislation are the E.U. Directive establishing a framework on energy labeling (92/75/EC) and the U.S. National Appliance Energy Conservation Act (NAECA) of 1987, updated in 1988. The E.U. Directive gives authority to the European Commission to issue product-specific energy labels following approval from a committee of nationally appointed civil servants. The NAECA legislation empowers and obligates U.S. DOE to issue minimum energy-efficiency standards for energy-intensive tradable equipment when a specific set of criteria is met. For a fuller discussion of framework legislation see Waide (1998).

3.2.3 Assigning Authority and Responsibility for Implementation

Ideally, it is easiest if one governmental agency has overall responsibility for developing, issuing, and maintaining both labels and standards, to ensure that they are enacted and upgraded in a consistent manner. Frequently, however, there are conflicting institutional claims for control of the programs. For example, in some countries, a division of resources has meant that different agencies or institutions are responsible for separate energy/environment endorsement labels, comparative energy labels, "ecolabels," or minimum efficiency standards. In several countries, this type of split responsibility has been effective. In situations where several agencies are or may be involved, conflicting claims must sometimes be addressed and resolved to avoid a damaging division of resources that will reduce program impacts. When authority for various elements of standards-setting and labeling programs is spread among more than one agency, coordination among the agencies must be designed into the programs. Even if one agency has the lead for the entire program, effective implementation requires close coordination with a number of other agencies to enlist their support. A single agency rarely has all the skills necessary to develop labels and standards in house. Depending on the skills and procedures of the agency or agencies in charge, it may be wise to hire outside experts to assist in program management, including program oversight, data collection, product registration, and coordination with other agencies.

3.2.4 Maintaining Political Support for Program Development and Operation

Standards must evolve with products and their markets, and a coalition of manufacturers and other interested parties must be maintained to support effective implementation and operation of a program over time. Without such political support, opportunities could be missed for substantial energy savings and carbon emissions reductions. In addition, a standard that is too stringent or overly prescriptive can evoke a manufacturer backlash and create an unintended obstacle to development of efficient products.

Standards should be regularly revised and updated. In many cases, this requires a substantial analysis of their viability and cost effectiveness. The revision process can itself be a source of controversy. For example, in the U.S., the process of standards development was delayed for more than a year during 1995-96 because of stakeholders' discontent with both their limited involvement and typically long delays. It is necessary to establish a revision process that minimizes non-substantive issues of disagreement and allows full consideration of substantive issues. In the U.S. case, the program mentioned above got back on track only after an extensive reform of the standards-setting process gave stakeholders more say in each step—from priority-setting to final rule-making (Turiel and Hakim 1996).

It is also important for policy makers to keep in mind that ongoing resources are needed over many years for the development, maintenance, operation, and evaluation of a labeling or standards-setting program. Substantive negotiations on the technical details of standards cannot take place without high-quality technical data and analysis as well as periodic program evaluation, both of which must be funded. Well-designed framework laws/decrees and procedural rules cannot be followed if they are not accompanied by adequate funding.

3.3 Step D-3: Consider Regional Harmonization

The third step in deciding whether or how to develop a labeling or standards-setting program is for policy makers to determine the extent to which they can rely on elements of standards-setting and labeling programs that are already established by international organizations or in neighboring countries. Harmonizing may involve adopting existing test procedures, agreeing to mutual recognition of test results, and/or aligning performance standards levels and energy-labeling criteria for particular appliances.

The term "harmonization" is commonly used in international trade negotiations (particularly in the World Trade Organization) to refer to the use of common standards, test procedures, import tariffs, etc. for the purpose of liberalizing or facilitating international trade. In some regional organizations, e.g. the Asia-Pacific Economic Cooperation forum (APEC), the preferred term is "alignment," which refers to unilateral action by any member economy. In this edition of this guidebook, we use the term "harmonization" to refer to multilateral cooperation to establish uniformity in any aspect of standards-setting or labeling. We use "alignment" to mean the unilateral adoption of previously established test procedures, standards methodology or levels, or label criteria or design from outside the country.

3.3.1 Rationale for Alignment and Harmonization

Alignment and harmonization allow countries, companies, and consumers to avoid the costs of duplicative testing and non-comparable performance information, thus benefiting from a reduction in these non-tariff trade barriers and from access to a widened market of goods. Most electrical products and appliances are subject to national standards that specify minimum safety and performance requirements. Because countries have different industrial or product standards, it is difficult and time consuming for a manufacturer or exporter to carry out the necessary tests and get customs approval to import a product into many different countries. Costly and time-consuming customs procedures amount to a non-tariff trade barrier.

The major goal of harmonization is to reduce non-tariff trade barriers by (IIEC 1999):

- simplifying and harmonizing customs procedures among countries
- harmonizing test procedures, labels, and standards
- implementing mutual recognition agreements (MRAs)

Recognizing the benefits of harmonization, many countries are participating in regional activities directed at harmonizing energy-efficiency standards and labels and the testing that underlies these measures. Such activities are being undertaken by APEC, the South Asia Regional Initiative for Energy Cooperation and Development (SARI/E), the Pan American Standards Commission (COPANT), the Association of Southeast Asian Nations (ASEAN), and the North American Energy Working Group (NAEWG). The E.U. has a rich history of regional coordination as a result of the conversion from individual country standards and labels to a unified E.U.-wide program. These harmonization efforts address the shared interests of the participants in mutually agreeable test facilities and protocols; mutual recognition of test results; common comparative energy label content; consistent endorsement energy labels; consistent minimum energy-performance standards for some markets; and shared learning about the labeling and standards-setting processes (Wiel et. al. 2003).

By design, government standards-setting and labeling programs are intended to influence the ways in which manufacturers of energy-consuming products produce and distribute their products. Harmonization not only facilitates the globalization of appliance, equipment, and lighting-product markets, it also offers governments the opportunity to make energy efficiency standards-setting and labeling programs more stringent and more effective than they might otherwise be. For example, Mexico's participation in NAEWG appears to have accelerated the harmonization of its minimum energy-performance standard for refrigerators with those of the U.S. and Canada. Harmonization discussions can be complex and slow because standards, harmonization, and trade regulations are negotiated based on strategic advantages for participants. Reduction of trade barriers is not necessarily "beneficial" to all concerned, especially when either importers or local manufacturers might have significant competitive advantages in particular countries.

Below, we discuss the relative pros and cons of aligning or harmonizing test procedures, labeling, and minimum energy-efficiency standards

3.3.2 Aligning or Harmonizing Test Procedures

Many countries already have a government-backed institution to oversee the development of testing and certification procedures for industrial and consumer products. Typically, the mandate of these standards agencies is to certify the safety and performance of designated products. Safety and performance standards are usually adopted by a local technical committee and are aligned with international standards such as those developed by the International Organization for Standardization (ISO) or the International Electrotechnical Commission (IEC). For most products, safety and performance standards specify protocols for testing performance and mandate some minimum levels of safety and quality. Only occasionally do national standards include energy efficiency as a criterion. Each country must decide how to design a minimum energy standards program, drawing on the resources and expertise of the existing standards agency, the national energy agency, and other qualified bodies.

In general, it is beneficial for national test procedures to be harmonized as closely as possible with international test procedures in order to reduce non-tariff trade barriers. However, there are other pragmatic reasons for adopting international test procedures including:

- avoiding "reinventing the wheel" (developing product energy-performance test standards is a complex and time-consuming activity)
- simplifying test laboratory accreditation; relying on shared procedures makes it possible to establish the proficiency of a country's designated test lab(s) through cross-testing with an international laboratory using the established standard (see Chapter 8)

- facilitating energy-performance benchmarking of local products against international levels

In practice, there are varying degrees of harmonization, depending on the extent to which a country allows for changes or exceptions to the international test procedure. The best international testing protocols cover many climate conditions and a broad range of operating conditions, and test results from harmonized protocols readily allow for product comparisons. However, in some cases, a country may adopt modified test conditions to reflect the local operating environment for a product. In addition, some countries may require testing of product characteristics that are unrelated to energy use (e.g., noise level) to ensure that energy-efficiency gains are not achieved at the expense of other elements of product performance. Energy testing of appliances and equipment is discussed in more detail in Chapter 4.

3.3.3 Aligning and Harmonizing Labels

Consensus on the benefits of aligning or harmonizing labels is much less strong than consensus on aligning or harmonizing test procedures and accreditation. Non-uniformity of test procedures and accreditation poses a much bigger barrier to trade than does the lack of harmonized labeling schemes for appliances and equipment. There is little justification for harmonizing labels unless there is evidence that a label used in one country or region would also be effective in other countries or regions (Harrington 1997). In fact, an effort to harmonize all information on energy labels among several countries could reduce the impact of the label in each country because the optimal design elements of an effective label may be different in different cultures; symbols or graphic elements that work in one country may not necessarily transfer to another. The best way for policy makers to design effective labels is to carry out consumer research in their country to determine which label design can be most readily understood and is most likely to influence consumers to purchase an energy-efficient product.

When considering harmonization of any aspect of a country's labeling program, separate consideration should be given to 1) metrics and category definition for the comparative label, 2) appearance of the comparative label, 3) criteria for the endorsement label, and 4) appearance of the endorsement label. The benefits of harmonization and the approach used to achieve it will vary among the four options. Any of the four elements may be pursued, singly or in combination.

Despite the above warning against an excessive focus on harmonization of labels, the successful "harmonization" of the energy label among 15 countries and 10 languages of the E.U. shows that it is possible to devise a functional unified label that works across borders. Even slightly different labeling requirements among nations can be disruptive to trade and can ultimately limit choices and add to consumer costs. A regional labeling approach is appropriate if the marketplace, particularly for imported products, is more regional than national.

For smaller, developing countries with little or no manufacturing capacity for a particular product, harmonization could strengthen the national economy by fostering trade in a common regional market. An example of such a regional label is the ASEAN endorsement label that is being developed for high-efficiency fluorescent lamp ballasts and other products. The ASEAN program would make an endorsement label available for any products in the region that meet an agreed-upon threshold for "high efficiency" and allow smaller or less-developed countries in ASEAN to jump-start a labeling program for certain products by adopting the new regional label (see insert: *The ASEAN Energy Labeling Scheme* on page 114 in Chapter 5).

3.3.4 Aligning or Harmonizing Energy-Efficiency Standards

If standards are to be adopted, careful consideration should be given to whether to harmonize the standards regionally or internationally. A series of different standards applied in the same trading region can have a significantly disruptive effect on commerce for both native and importing industries. The benefits of aligning or harmonizing minimum energy-efficiency standards are important, but they may be secondary to the primary benefits of the standards themselves. Harmonization should not become the excuse for avoiding or delaying implementation of a labeling or standards-setting program. However, the process of adopting standards may be shortened if the proposed standard is aligned with standards that exist elsewhere, which can help justify the standards level. In some cases, it may be expedient to take a longer-term approach to alignment by first adopting an earlier, less stringent version of a trade partner's standard, with a commitment or intent to upgrade it to the current level in the near future.

Harmonization of mandatory rules limiting the sale of inefficient products may require significant tact and diplomacy, both within one's own country and among trading partners. A developing country that is struggling economically may not find it practical to establish minimum energy-efficiency standards that are aligned with the energy-efficiency standards of large developed nations such as Japan or the U.S. There are a number of reasons for this, including:

- there is likely to be a lack of energy-efficient products available in the developing country
- any incremental cost of energy-efficient products is likely to be high relative to average income in the developing country
- tough energy-efficiency standards may hurt local industry and benefit importers of foreign products

Still, harmonization of standards has often been found to be useful, and more and more countries are discussing regional cooperation.

3.3.5 Using Mutual Recognition Agreements

MRAs are "multilateral arrangements between two or more economies to mutually recognize or accept some or all aspects of another's conformity test procedures (e.g., test results and certification)" (IIEC 1999, Motoomull 1999, Rath 1999). MRAs simplify cross-border trade in products that must be tested and inspected. Broadly speaking, there are two types of MRAs: intergovernmental and technical.

Intergovernmental MRAs

Intergovernmental MRAs are, as their name indicates, established between governments; they cover products that are regulated by the government sector, such as electrical appliances, telecommunications, or food products. These agreements can be bilateral or multilateral. The recent trend has been toward multilateral MRAs, such as the APEC Electrical MRA, because forging agreements of this kind is much less time consuming than establishing separate, bilateral MRAs with a number of different countries (see insert: *APEC Mutual Recognition Agreement*).

Technical MRAs

Technical MRAs establish technical equivalency among bodies in different countries. These types of agreements can cover laboratory-accreditation, inspection-accreditation, and testing-certification. The key usefulness of technical MRAs for electrical products is that they eliminate the need for retesting a product in a foreign country. For example, technical MRAs between European and U.S. laboratories allow the results from a European test laboratory that tests a product according to a U.S. test procedure to be accepted in the U.S. without requiring retesting.

3.4 Step D-4: Assess Data Needs

To optimize the design of a labeling and standards-setting program, it is necessary to gather, organize, and analyze a large number of diverse data. The fourth step in deciding whether and how to develop labeling and standards-setting programs is to assess the program's data needs and the capability of the government to acquire and manage those data.

Many more data and much more analysis are required to justify a sound, mandatory energy-performance standard than are needed to justify a voluntary standard, a comparison label, or an endorsement label. This is one reason that consideration might be given to a voluntary program when a government is in the initial stages of developing a standards-setting program; this is also a reason for considering adoption of standards levels from another country.

APEC Mutual Recognition Agreement

The APEC Electrical Mutual Recognition Agreement (MRA) is an example of an intergovernmental MRA that was established to facilitate trade in electrical products within the APEC region, which includes 22 countries in the Asia-Pacific basin. The MRA has three main components:

Part 1: information exchange agreement

Part 2: mutual recognition of test results

Part 3: mutual recognition of certification

These are separate parts of the MRA, and a country can choose to sign onto just one (e.g., information exchange) or all three. The MRA covers most electrical products except telecommunications equipment, which will be covered under a separate APEC MRA. The Electrical MRA was completed in 1999. The current draft of the Electrical MRA covers safety and performance requirements but not energy-efficiency requirements.

The MRA will reduce the barriers to trade in energy-using products by reducing the need to test a product several times to import it into multiple countries. This MRA will facilitate trade in electrical products with other signatory countries because test results certified by an accredited laboratory in that country will be recognized by other signatory countries.

If a country chooses to proceed with mandatory standards, far less analysis and expense are required to justify, for example, a simple standard that eliminates the 10 or 20% or even 50% of products that are least energy efficient, compared to what would be needed to support a stringent standard that would require most or all products to be upgraded. The stringent energy-standards regimes of the U.S. and E.U., for example, are based on life-cycle cost and technological feasibility and thus require relatively expensive iterations of data collection and analysis for each product regulated. An exception to this model is the Australian approach to developing minimum energy-performance standards, which is based on matching "world's best regulatory practice" (see insert: *Australia Aligns With the World's Best Practice* on page 28 in Chapter 2). Although the Australian approach uses international benchmarks as a basis for setting energy-performance requirements, many other variations are possible.

3.4.1 Evaluating the Types of Data Needed for Analysis

The data needed for labels and standards development can be put into five broad categories: market, engineering, usage, behavioral, and ancillary. These categories are described in the following paragraphs, but, first, a word of caution: although it would be ideal to have complete data for all the items listed in each category below, all countries manage to get by with incomplete data. Administrators should avoid being overwhelmed—scared off—by the volume of data required. No country in the world has managed to collect complete data on all listed items; countries use the best estimates that can be collected from available resources.

Market Data

General and specific market data are needed to assess potential program impacts and to optimize program design whether the program addresses comparison labels, endorsement labels, standards, or all three. The data needed include:

- equipment annual sales volumes
- sales prices
- production volumes
- import and export volumes

as well as information on:

- equipment distribution channels, including
  - how equipment is distributed from manufacturers and importers to retail outlets and final consumers
- retail-sector characteristics, including
  - market shares by retail type and sector, e.g., electrical specialists /retailers, furniture or kitchen specialists, department stores
  - retail marketing strategies and niches
  - geographical spread
  - typical profit margins
- manufacturing-sector characteristics, including information on
  - competition

- market shares
- brands
- parent groups and trade alliances
- share of production
- exports and imports
- type of production—e.g., full production, final assembly only
- type and quality of products produced
- production capacities
- component suppliers
- distribution of production
- costs of marketing, transportation, and vending
- costs driven by regulatory policy
- typical profit margins
- research, design, and development investments
- technical capabilities
- access to high technology
- flexibility of production process

Most of the types of data listed above should, ideally, be disaggregated into sales by equipment subcategories and efficiency levels. For example, room air conditioners can be further divided into subcategories of: single packaged (through-the-window or wall units), split-packaged (units with separate condenser and evaporator units linked by a refrigerant line), multi-splits (split, packaged units with a single condenser unit and more than one evaporator unit), and single-ducts (integrated portable air conditioners where exhaust heat from the condenser is discharged to the outside via a tube or duct). The subcategories should also be grouped by size (e.g., cooling capacity), if possible. Historical time series data are the most useful and should continue to be gathered after a program is under way, for use in program evaluation.

Engineering Data

The goal of gathering engineering data should be to assemble a comprehensive database of summary technical and energy characteristics for individual product models available on the market. Engineering data should include:

- comprehensive technical descriptions of typical (baseline) products for energy-engineering simulations used in developing standards. For example, for some pre-selected, average-efficiency room air conditioners, this might include data on the compressor, accumulator geometry, evaporator coil, evaporator blower, refrigerant line, flow-control device, condenser coil, condenser fan, and operating temperatures and pressures

- component and material cost information for use in estimating life-cycle product costs associated with incremental design improvements to increase efficiency

Usage Data

Usage data include:

- historical, annual, time-series data on equipment ownership levels and energy use or energy efficiency, ideally broken down by equipment subcategories
- demographic statistics such as the number of households, number and size of office buildings, distribution of occupants per building, socioeconomic characteristics of occupants, information about occupants by income level and region, typical occupancy patterns
- existing equipment stock, including the rate of replacement and rate of acquisition (needed for forecasts of the equipment market and of energy consumption)
- end-use measurements of how the equipment is used in practice, both nationally and in different climate regions (for climate-sensitive appliances), including energy consumption, power demand, and time and frequency of use (Sidler 1997)

Behavioral Data

Behavioral data include:

- desired product utility and features
- attitudes of consumers and equipment users toward energy savings, purchasing decisions, label designs, environmental concerns, and product service
- retailer attitudes toward and knowledge of energy efficiency in general, labeling, selling priorities, and consumer preferences
- manufacturer attitudes concerning energy efficiency in general, energy labeling, specific label designs, product energy performance, and marketing priorities
- socioeconomic segmentation of equipment purchasers and users

Ancillary Data

Ancillary information includes:

- data and forecasts for energy prices and tariffs
- data on utility generation, transmission, and distribution, including capacities, demand, costs (peak and off peak), and the fuel mix
- national energy statistics

- national trade, economic, and employment statistics
- data on direct and indirect environmental emissions
- data on any additional environmental impacts of equipment production and usage
- comparative data on the effectiveness of alternative and complementary energy-efficiency programs

Of course, it is not always possible to gather all of the data listed above in a thorough and systematic manner. Prior to designing a program, officials should establish minimum data needs and prioritize the need for the remaining data. The intended use of the data must be clearly defined, and proxy data or reasonable assumptions should be used whenever specific data are not available.

3.4.2 Specifying the Data-Gathering Process

It can be very difficult to gather detailed, product-specific engineering and cost data from manufacturers and suppliers unless a high level of trust has been established between manufacturers and government. Manufacturers should be brought into the labeling or standards-setting process from the outset through the formation of a stakeholder committee. The committee structure allows manufacturers to present their views and concerns and to "buy in" to the process. In addition, the committee can facilitate the process of collecting data to analyze the impact of the labeling and standards-setting program.

There are a number of sources for the necessary data:

- Stakeholders, i.e., parties who may have an interest in the required data, should be the first point of contact. They can be helpful in identifying a range of data sources including existing literature, reports, or market surveys when available.
- Industry organizations, such as trade, manufacturer, or retailer associations, will often have valuable market and product data that they may be prepared to share.
- Market research companies may be prepared to sell market data (older or aggregated data may be available at a discounted price).
- Manufacturer catalogs can be good sources of model-specific technical data for statistical analyses.
- Long-established test laboratories often have model-specific data on product performance.
- Direct contact with manufacturers is the best way to gather detailed engineering data and data on production processes and manufacturing costs.
- Surveys and questionnaires can be used to gather behavioral data. These data may already be available from local market-research firms.
- Government ministries and information agencies and their publications are the best source of ancillary and demographic data. These agencies include census bureaus, national statistics bureaus, ministries of industry or energy, information centers, customs departments, housing authorities, and electric utilities.

- International reports and databases can provide useful benchmarking and proxy data that can be used to carry out a reality check of local data and can also be used as a starting point in program design.

3.4.3 Finding a Home for the Data

Policy makers should designate an institutional home for the data generated throughout the course of the labeling or standards program. In both industrialized and developing countries, outside consultants are often contracted to collect and analyze the data. Both governments and funding agencies must recognize the need for skill transfer so that, when consultants complete their task, the local institution can maintain the database. The local institution should not only store the data, but should also be capable of updating the database, providing useful and consistent analysis based on it, and making it available to third parties such as academics who may wish to use it for research and analysis. A publicly available data set can have significant benefits for the country as government officials, consultants, academic researchers, and others can then design companion programs or test alternative standard or label designs based on common information and assumptions. Over time, this developing database should allow for a powerful understanding of the trends and potential for energy efficiency in end-use appliances and equipment.

3.5 Step D-5: Select Products and Set Priorities

The fifth step in the process of deciding whether and how to develop labeling or standards-setting programs, as shown in Figure 3-1, is to screen and select which combinations of program type and product class are the highest priorities. All energy-consuming products—and some non-energy-using ones, such as windows—are candidates for labels and standards. In theory, there are no limitations on which products can be addressed by energy-efficiency regulations. However, these regulations require considerable financial and managerial resources, so it is only possible and practical to develop labels and standards for a limited number of products at a time. It is therefore necessary to establish priorities among a government's market-transformation policy options and among the products within the labels and standards option based on which regulations are likely to have the most impact and are easiest and most practical to design and implement from a market perspective. In practice, for reasons that will be explored below, both regulatory and non-regulatory energy-efficiency policies have focused on only a few products.

3.5.1 Selecting the Program Approach

Should we start with labels or standards? Should we start with comparative labels, endorsement labels, or both? Should we start with a mandatory or a voluntary program? These are the first decisions that officials typically face when beginning a new labeling and/or standards-setting program. There is no single right answer to these questions, or perhaps a better way to put it is to emphasize that there are no wrong answers. The best path for any given government at any given time will depend on a complex array of political, social, economic and technical factors, including which appliances, equipment, or lighting products will be addressed by the program that is being designed.

For example, the decision of whether to start with a voluntary or mandatory label may appear difficult. Many practitioners feel passionately that comparative labels must be mandatory to be effective. However, voluntary energy labeling programs may require little or no formal regulation. Voluntary comparative labeling schemes have been implemented in countries as diverse as Thailand, Hong Kong, India, and Brazil, with varying success. In these voluntary regimes, only appliances in the higher-efficiency classes tend to carry labels because manufacturers and retailers of lower-efficiency products have no incentive to advertise that their products are inefficient (see insert: *The Voluntary Labeling Program in Thailand*). When only the most efficient products have a label, the comparative label becomes an endorsement label indicating the top-rated models.

As a general rule, governments find it easier to start by creating an energy labeling program rather than a program that sets minimum efficiency standards. This is true because labels provide consumers with information and can encourage a shift toward higher-efficiency products, but labels do not require the phase-out of existing low-efficiency products. It is harder to build support for minimum standards, which impose more significant and immediate market changes.

The Voluntary Labeling Program in Thailand

The Thai voluntary labeling program has worked well for refrigerators but has been less effective for air conditioners. After two years of the program, 85% of single-door refrigerators in the market had achieved an energy label ranking of 4 or 5 (5 is the highest ranking), and, after four years, 92% had achieved label rankings of 4 or 5, with more than 95% of these labels being the top-rated 5 ranking. Because the label levels were initially set with 4 being 10% more efficient than the market average and 5 being 25% more efficient than the market average, this indicates that the labeling program resulted in a roughly 25% increase in the average efficiency of single-door refrigerators (Agra-Monenco International 1999). Since the initial program evaluation was completed in 1999, the label has been made mandatory for single-door refrigerators, and all models in the market are now labeled. It is worth noting that the voluntary label was supported by an extensive promotional campaign and budget, which played a large role in both getting the manufacturers to join the program and in raising awareness among Thai consumers.

The voluntary labeling program for air conditioners has been less effective than the refrigerator labeling program because of the uneven distribution of air-conditioner efficiencies. In the air-conditioner market, high-end domestic and imported units have higher energy efficiencies but cost twice as much as the lower-priced domestic units that dominate the market. The lower-priced units often have very low efficiencies, and a substantial number are not properly registered for sale to avoid the excise tax on air conditioners. Manufacturers or importers of the more efficient models attain a high label ranking (i.e., a 4 or 5) on their products, and the labels are only applied to models with the top 5 ranking. The remaining models—with lower efficiencies—are unlabeled (Danish Energy Management 2004). After three years of the program, fewer than 40% of models in the market were labeled (Agra-Monenco International 1999). Five years later, that percentage had increased only slightly, to approximately 50% of products.

3.5.2 Setting Screening Criteria

What are the main criteria for selecting products? The arguments for establishing product priorities are numerous; some of the most well known are described below.

Impact on total energy demand

For each product considered, the total energy demand of the current and/or future stock should be significant compared to the energy demand of the sector. Assessing the energy demand of a given end use may require a combination of market analysis, specific surveys, end-use metering, laboratory testing, and educated guesses. One problem may be deciding when the energy demand for a given end use qualifies as significant. To start with, any product whose stock represents more than 1% of total energy demand should be considered. Although it may seem counterintuitive to many policy makers, many new miscellaneous end uses can actually be quite significant. A study recently commissioned by the Australian government found that standby power use aggregated over an array of miscellaneous household, commercial, and industrial end uses represented the single largest source of potential energy savings for planned activities in Australia's National Appliance and Equipment Energy Efficiency Program (NAEEEP) (Australian Greenhouse Office 2003). In addition, given the increasing importance of mitigating greenhouse gas emissions and the availability of credits for carbon emissions reductions, the CO_2 emissions reductions that result from reducing energy demand should also be considered.

Level of ownership and turnover

Energy-efficiency policy should focus on products that have a high level of market penetration or for which market penetration is rapidly increasing. The penetration of a given appliance is measured by the level of ownership, that is, the percentage of households that own and use the equipment in question. The rate of increase in ownership is most important in choosing products to address through labels or standards.

In the current global market, the penetration of many new types of energy-consuming equipment, especially electronic and information technology products, is growing much faster than the penetration of traditional major appliances. Even though these electronic devices use less energy per unit than traditional household appliances do, their proliferation has a significant impact on energy demand. However, for the new generation of electronic equipment, such as personal computers, the short useful life of the products makes it difficult for regulators to introduce minimum performance standards in a timely and meaningful way. If we take personal computers as an example, we can see that it is difficult to assess the energy consumption of the next generation of processors when the technology is likely to change drastically within only one or two years. For these types of products, regulators may choose to establish minimum performance standards for some key aspects such as the power supply, display energy management, or standby losses. Endorsement labeling has been widely and effectively adopted for these types of products and has had a significant impact.

Potential for energy-efficiency improvement

A specific research study may be required to determine the potential for energy-efficiency improvements in a product. In particular, it is necessary to understand the importance of both the design of the technology itself and the impact of user behavior on final energy consumption of an appliance. For instance, refrigeration appliances are excellent candidates for an energy-efficiency standard because they run constantly, there are numerous technical options to improve their efficiency, and the impact of user behavior on final energy consumption is smaller than for many other products. At the opposite extreme, the energy consumed by an electric iron is primarily dependent on individual user behavior, and the technology is simple, so irons are less promising candidates for energy-efficiency regulation. Research studies have been carried out on most products, and these studies usually provide an adequate basis for any country that is taking its first steps in standard-setting or labeling; using these existing studies rather than starting from scratch reduces the time and resources a country is obliged to devote to this task.

Anticipated stakeholder impact

The adoption of mandatory energy-efficiency labels and standards creates winners and losers. Some manufacturers and distributors will benefit, and some will be worse off. Some consumers will profit, and some will never recover their added investments in energy-efficiency features. For both manufacturers and consumers, there will be a range of profitability and loss. (An example of the magnitude and extent of benefits and losses can be seen in Chapter 6). When choosing products for standards or labels, it is useful to anticipate the extent to which some manufacturers or consumers might be significantly disadvantaged despite the program's overall societal benefits.

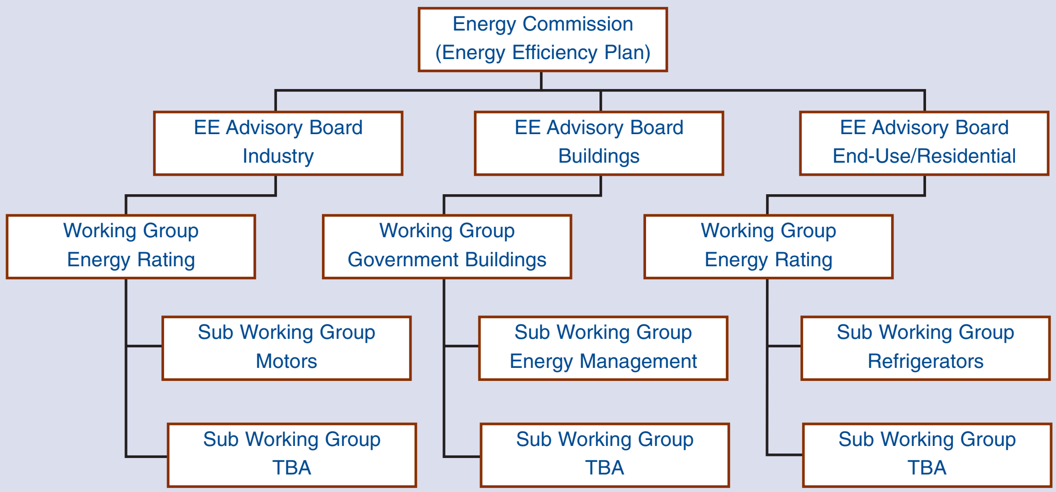
If especially stringent standards levels are anticipated for any product, consideration should be given to the possibility that some manufacturers or consumers of that product will be unhappy. In general, the range of gain or loss for consumers depends on the normal purchase and operating costs for the appliance, and well-designed standards explicitly consider the tradeoffs between costs and benefits. Regulators need to consider whether the regulations might cause any manufacturer to close a production plant, which could result in the loss of local jobs. Conversely, tougher standards can also be a stimulus for employment in that they can drive industrial renovation and boost local competitiveness. In addition, jobs may be created as consumers spend the savings from reduced energy bills.

As will be discussed in detail in Chapters 5 and 6, it is extremely important for regulators to design a process for stakeholder input into the design of standards; experience around the world shows that stakeholders are not shy about expressing their preferences and concerns, which offers program implementers ample opportunity to learn what those specifically impacted by any proposed regulation have to gain or lose. Such input can be used to inform the program design and develop a broad-based consensus. Malaysia, for example, has developed a stakeholder advisory process as part of its overall demand side management (DSM) programs. This process has been used to particular effect in the initial selection of voluntary labeling programs for refrigerators and electric motors (see insert: *Malaysian Stakeholder Input Process* on next page).

In some situations, it may be appropriate to consider measures that mitigate negative impacts of standards. For example, it is possible to provide a rebate at the point of sale to minimize any anticipated increase in product price resulting from the standards. Tax relief might be in order as an interim measure to mitigate the impact on manufacturers who are adversely affected by a particular standard.

Malaysian Stakeholder Input Process

The Malaysian Energy Commission wishes to ensure that the country's energy-efficiency (EE) programs maximize the needs and interests of the stakeholders and end users. In order to encourage stakeholder participation in the design, planning, and implementation of new activities in the Malaysian EE programs, the Energy Commission has involved a number of boards and working groups to look into energy-efficiency activities in three key areas: industry, buildings, and end-use/residential, as shown in the following diagram.



The working groups are made up of representatives from government, industry associations, and individual companies, and experts from universities and the consulting industry. The working groups have been effective mechanisms for setting priorities—for example, advising that energy-labeling efforts begin with refrigerators and electric motors. The sub working groups have subsequently been closely involved in the design of voluntary labeling programs for these two product types. Industry representation in the working groups has aided the Energy Commission in developing its market surveys and assessment, and the working group was the forum in which memoranda of understanding (MoUs) were developed that laid the basis for the programs.

The administration and management of the groups are handled by the Energy Commission where task managers for each sector (i.e., industry, end use, and buildings) have been appointed. The Energy Commission is not obliged to follow the recommendations of the work groups, but, in practice, the work group recommendations are generally used as the basis for the final program design.

Coverage by test procedures

A test procedure that establishes the performance, including energy consumption, of a given product must exist before energy labels or minimum performance standards are implemented. It is always preferable to reference international standards and test protocols when developing minimum energy-performance standards; these could be the widely used IEC and ISO test procedures or they could be regionally accepted ones such as U.S. DOE test procedures.

For some products—e.g., new products and products that are used only in some regions—international test protocols may not exist. This is the case for rice cookers, for example, which have a high market penetration in some cultures where rice is a staple food. In cases like these, a test protocol must be designed with the goal of sound energy performance not only when the product is in use but also when it is not performing its primary function, for example while in standby mode.

Existence of energy-efficiency regulations in other parts of the world

Many energy-consuming products are traded internationally. It is a good idea when proposing a new standard to at least consider adopting (or adapting) the applicable regulations from the exporting country. For example, minimum energy-efficiency standards for household refrigerators are in place in several parts of the world, including North America, Europe, Japan, and Australia. As a result, refrigerators are priority candidates for energy-efficiency regulation elsewhere. Policy makers can save time and resources and avoid having inefficient products dumped in their countries by examining existing regulations in other markets and adapting those regulations to their own national markets. However, policy makers must exercise caution when adapting existing regulations from other markets and consider and account for local user habits, power distribution infrastructure, and other influential factors.

Existence of an energy-labeling scheme

Energy labeling, perhaps in the form of an initial voluntary program, may be the best way to begin a labeling and standards program that will lead to eventual introduction of minimum performance standards. Manufacturers of appliances covered by an existing energy-labeling program are made aware of the need to conserve energy and are thus in a better position than most manufacturers to recognize the impact of marketing products that consume less. They may also be better prepared to participate in negotiations to set minimum performance standards.

In Europe, negotiated energy-performance targets have been established for both domestic clothes washers and dishwashers, among other appliances. These targets were based directly on the energy-efficiency rankings in the energy-labeling scheme and may eventually become mandatory minimum performance standards. In Thailand, voluntary labeling programs initiated during the late 1990s paved the way for mandatory labeling for single-door refrigerators in 2001 and for minimum performance standards taking effect in 2005 for several other products.

A starting point for prioritization

Table 3-1 classifies appliances into two tiers based on the priority for establishing minimum energy-performance standards for these products. This list is meant to illustrate the screening approach described in the preceding subsections. Of course, the specific results in any one country will vary according to the prevalence and use of each appliance or product.

3.5.3 Addressing Standby Power Requirements as a Crosscutting Issue

One dilemma facing the energy-performance standards community is how to address unnecessary electricity consumed by electrical equipment when it is switched off or not performing its main function. These low-power-mode losses (often called "standby losses") are estimated to account for about 3 to 15% of home and office electricity use (www.energy.ca.gov/reports/reports_500.html#500). Standby losses are mostly attributable to audiovisual equipment (e.g., televisions and video equipment with remote controls), electrical equipment with external low-voltage power supplies (e.g., cordless telephones), information technology (e.g., computers and office equipment), and devices with continuous digital displays (e.g., microwave ovens).

Standby losses raise a number of very difficult questions for policymakers and regulators. How can test procedures account for the various ways that products operate when not being used for their primary function? Should standards be developed or modified product by product to address these losses? Should there be a single standard that restricts low-power-mode operation and power use on a collection of products? Should standards officials leave this issue to their colleagues who are developing endorsement labels?

In 2002, the International Energy Agency (IEA) launched a worldwide initiative to reduce standby power consumption, and there is general agreement that action is urgently needed to avoid large increases in standby power use. A number of Organization for Economic Cooperation and Development (OECD) countries and regions have policies to address low-power-mode use; other regions have launched similar initiatives. Several policy instruments can be used to tackle the international problem of standby power consumption, including voluntary or mandatory labeling and/or minimum performance standards.

The E.U. strategy for reducing standby power use has been primarily based on negotiated agreements and voluntary E.U. Codes of Conduct that set maximum standby power consumption levels as alternatives to mandatory efficiency requirements. Australia, in a joint initiative of Commonwealth, State, and Territory Governments, has adopted a one-watt target for standby energy consumption of all manufactured or imported products and is developing a national strategy to achieve this goal. Two policies address standby power in Japan: one is the ENERGY STAR program under an agreement with the U.S. government and the other is the Law Concerning Rational Use of Energy, which requires manufacturers and importers of designated appliances to make efforts to improve the energy efficiency of their products. China has approached the issue by adopting a voluntary ENERGY-STAR-type labeling scheme for several products (Bertoldi et. al. 2002) and is considering minimum energy-performance standards as well. The U.S. is addressing the issue through its government procurement policy, its voluntary ENERGY STAR labeling program and individual product performance standards. In 2003, the U.S. amended the test procedure for dishwashers to require that manufacturers or private labelers include measurement

Table 3-1 **A Sample Priority List of Appliances to be Covered by Minimum Energy-Efficiency Standards**

Because most countries have the capacity to implement labels or standards for only a few products at a time, it is important to pick those that will have the greatest impact first.

Top Candidates for Minimum Energy-Efficiency Standards
Household refrigerators, freezers, and combined refrigerator-freezer units
Air conditioners
Fluorescent lamp ballasts
Fluorescent tube lamps
Electric motors
Washing machines, tumble dryers, and combined washer-dryer units
Boilers
Storage water heaters
Heat pumps
Pumps
Fans
Public Illumination and lighting systems
Standby power
Second-Tier Candidates for Minimum Energy-Efficiency Standards
Cooking products (including stoves, rice cookers, and hot plates)
Dishwashers
Chillers
Commercial refrigeration appliances
Electricity distribution transformers
Photocopiers
Other lamps (compact fluorescent, incandescent, high-intensity discharge) and illumination and lighting systems for buildings
Computers
Office equipment and new information technologies
Peripheral equipment for television sets [videocassette recorders (VCRs), satellite antennae, decoders, set-top boxes]
Personal computers
Peripheral equipment for personal computers (printers, modems) (standby power)
Radio sets, stereo equipment (standby power)
Telephone apparatus, fax machines (standby power)
Television sets
Lifts/elevators

This table classifies appliances into two tiers that indicate the priority for establishing minimum energy-performance standards for these products. The classification is based on the international experience of the authors and reviewers of this guidebook. Actual priorities in any country will depend on local conditions (e.g., dishwashers may not be a priority in some developing countries because of very low market penetration).

of standby power consumption in the estimated annual operating cost and estimated annual energy use calculations for all dishwasher models (www.eere.energy.gov/buildings/appliance_standards/residential/dishwashers.html). California has been developing and testing procedures for measuring power levels of various residential equipment operating in low-power modes.

As this guidebook goes to press, there is considerable momentum developing to address standby power use on an international basis. So far, the collaboration includes the U.S. Environmental Protection Agency (U.S. EPA), Australia's National Appliance and Equipment Energy Efficiency Committee, Eletrobras and Procel in Brazil, Natural Resources Canada, China Certification Center for Energy Conservation Products (CECP), and the California Energy Commission.

3.5.4 Assessing Potential Costs and Impacts

During the process of screening products, analysts evaluate the likely energy savings, cost savings, and associated environmental benefits from developing standards and/or labeling. Products to be included in the program are ranked in terms of cost effectiveness and potential for savings. If a country has national goals for total energy savings, these goals help guide the screening process.

The basic steps in assessing the potential cost and impact of a standards or labeling program are listed below. Generally, studies that have been conducted by other countries can be readily adapted or at least can provide an appropriate methodology for a country newly considering labeling or standards.

1. Develop a baseline model for the candidate product—The baseline represents the energy performance of a typical model of a given product (e.g., refrigerators) and is the starting point for an engineering analysis. Baseline characteristics determine what type of design modifications can be made to the product to improve its energy efficiency.

2. Identify potential energy-efficiency improvements—This step involves assessing the technical options available for improving the energy efficiency of each product.

3. Estimate the cost of energy-efficiency improvements—Based on market research, the energy-efficiency improvements and extra manufacturing costs associated with each of the options can be calculated, and analysts can evaluate any associated increased manufacturing costs likely to be passed on to the customer through the supply chain (see insert: *Use of a Cost-Efficiency Table*). Alternatively, analysts can collect data on the cost and performance of existing units on the market, to determine a cost-efficiency relationship.

4. Calculate the potential savings from energy-efficiency improvements—This step involves estimating the energy savings from the energy-efficient design options for each product.

5. Calculate cost effectiveness—This step involves estimating the life-cycle costs and payback periods for different levels of minimum energy-efficiency standards or from a labeling program (see Table 3-2).

Use of a Cost-Efficiency Table

A cost-efficiency table can be used when deciding how to establish a level for minimum energy-efficiency standards. Table 3-2 is a real example from a recent analysis that was performed to establish minimum energy-performance standards for Thailand. The table begins with a row showing the annual electricity use of a baseline ("base case") Thai refrigerator: 255 kWh/year. It then shows the cost and energy-efficiency improvements associated with additional technical measures that can be adopted to improve the refrigerator energy efficiency. Note that the first few measures are the most cost effective, with the highest benefit-cost ratios. Subsequent steps are still cost effective but have slightly lower benefit-cost ratios. Although methodologies for more sophisticated analyses that account for variability among consumers and uncertainty in the data are available and can prove very useful when designing advanced policies, they are usually not needed for initial ventures into standards-setting.

A cost-efficiency table is a useful tool for establishing the appropriate level for a minimum energy-efficiency standard.

Table 3-2 Cost-Efficiency of a Thai Refrigerator

	Description	Annual kWh	Energy Saving (%)	Manufacturer Cost (Baht)	Retail Cost (%)	Benefit/Cost Ratio (see notes) This Step	All Steps
	Base case	255	N/A	N/A	N/A	N/A	N/A
1	Add 1 cm insulation to side walls	234	8.4	47	1.5	2.9	2.9
2	Add 1 additional cm to side walls (add 2 cm total, including Step 1)	227	11.1	94	3.0	1.1	2.3
3	Add 2 cm insulation to back walls (2 cm were added to side walls in Step 2)	216	15.3	137	4.4	1.9	2.1
4	Small "Good" compressor: 52.9 kCal/hr, 0.92 COP* (replacing 58 kCal/hr, 0.89 COP compressor)	201	21.1	237	7.6	1.1	1.7
5	Add run capacitor to small compressor: COP=1.01	183	28.5	362	11.6	1.1	1.5
6	Improve door gasket design (reduce gasket heat loss by 25%)	171	32.9	442	14.2	1.1	1.4

Notes:
- Baseline model is a 176-liter, 1-door, manual defrost refrigerator freezer.
- Each of the steps listed in this table is incremental to the previous step.
- The benefit/cost ratio is the ratio of the discounted net present values of the societal benefits to the societal costs.

* COP = Coefficient of Performance

Source: ERM-Siam 1999, p. 2-19

When discussing the results of such an assessment, it is often useful to distinguish among the following:

- technical potential: the maximum technically achievable energy savings
- economic potential: the economically optimum energy savings from a product-user's (consumer's) perspective
- achievable potential: the practical, sustainable energy-savings potential, given market barriers and competing policies

It is much easier to measure the savings potential for minimum energy-efficiency standards than for labeling because minimum energy-efficiency standards remove all products with a lower-than-mandated energy-efficiency level from the market, which makes the savings calculation comparatively straightforward. Comparative labeling, however, affects all models on the market, so any net energy-efficiency changes associated with labeling are difficult to separate from ongoing market trends and forecast.

Once cost and energy-efficiency data have been collected, baseline energy-efficiency information is used to estimate how much energy will be saved if the average energy efficiency of all models is increased by a certain amount. End-use forecasting models that accurately predict energy demand can be used for projecting policy impacts. In reality, however, detailed end-use data may not be readily available. In the absence of these data, simplified methods can be used to forecast the energy savings achievable from energy-efficiency standards. It is better to rely on simple forecasts based on limited but reliable data than on detailed forecasts from end-use models that are based on unreliable proxy data. An equipment stock model can organize product ownership and retirement data and use key demand drivers such as forecasts of the number of households and of household income. Such a model or spreadsheet can generate forecasts of equipment sales. In practice, crude sales forecasts are often made during the screening stage using simple spreadsheets that result in an acceptable estimate of the program impact.

Technical potential

An assessment of the technical potential for energy savings can be focused on the best theoretically conceivable design, the best design using conventional technologies, or the best design currently on the (national or international) market. These three reference points for measuring technical potential offer different levels of possibility for the "maximum" savings potential and the time horizon in which this potential could be achieved. Typically a national and/or international statistical analysis can be used to compare the difference in energy-efficiency levels between currently available products and the reference energy-efficiency level. The magnitude of that difference can be translated into savings potentials by assuming that all new equipment sales are at the higher energy-efficiency level in the energy-forecast model or spreadsheet.

Economic potential

The economic potential can be estimated in one of two ways. One method is to assume that labels and/or standards will achieve the greatest economic efficiency from the consumer perspective. This entails calculating the estimated incremental increase in product price against the expected reduction in the cost of operating the product for any given increase in the energy-efficiency level. In the absence of a thorough analysis, a rough estimate can be made using market data on the correlation (if any) between product price and energy efficiency. Another method is to assume that the labels and/or standards will achieve the greatest economic efficiency from a societal perspective. This will be the case when the initial costs of the energy-efficiency improvements are less than the net present value (NPV) of the utility's cost of supplying energy over the life of a product.

Achievable potential

Achievable potential is the analyst's best estimate of how much of the economic potential can be achieved in practice for a given product or program, based on experience with a similar program or product in another location or country. Achievable potential is less than economic potential because of the presence of market and non-market barriers that will reduce the actual savings achieved. The most commonly cited barriers are listed in Table 3-3. The shortfall is generally less for mandatory programs than for voluntary ones.

3.5.5 Planning for Phase-In, Evaluation, and Update

Minimum energy-efficiency standards need to be periodically reviewed and increased as the overall energy efficiency of products on the market improves and new technical options become available. The method and amount by which any minimum energy-efficiency standard is increased will vary depending on the product.

Table 3-3 **Possible Barriers to the Purchase of Efficient Products**

What appear to be cost-effective investments in energy-efficiency are often not made because of the presence of market and non-market barriers.

Possible Barriers to the Purchase of Efficient Products
Lack of awareness of energy efficiency
Lack of information about which products are more efficient (when there aren't effective energy labels)
Higher first cost
Low energy price
Low priority for consumers
Low priority for manufacturers/retailers
Equipment purchased by third party
Lack of available technology
Lack of government programs/support

Establishing a procedure for revisions will require input from the various stakeholder committees. It will also require a discussion of methods for setting and adjusting minimum energy-efficiency standards levels as well as for accommodating industry feedback on time frames that can be reasonably accommodated given other external pressures on manufacturers (see insert: *Malaysian Stakeholder Input Process* on page 61).

International experience has shown that the most effective minimum energy-efficiency standards regimes involve industry input in the establishment and periodic review/increase of minimum levels.

This chapter of the guidebook has discussed considerations that are useful in deciding whether and how to develop an energy-efficiency labeling or standards-setting program. Once the decision has been made to proceed, the next step is to establish test procedures and arrangements for testing of appliances and equipment. These subjects are addressed in Chapters 4 and 8.