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Appliance Efficiency

David R. Hodas



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UNEP GUIDE **FOR ENERGY EFFICIENCY AND RENEWABLE ENERGY LAWS**



UNEP Guide for Energy Efficiency and Renewable Energy Laws

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Table of Contents

TABLE OF CONTENTS	IV
FOREWORD	VI
ABOUT THE GUIDE	VII
ACKNOWLEDGEMENTS	XI
EXECUTIVE SUMMARY	X
SECTION ONE: ISSUES OF GENERAL APPLICATION	1
1A. ENVIRONMENTAL ASSESSMENTS	1
1B. DISCLOSURE AND PUBLIC PARTICIPATION	7
1C. ENFORCEMENT	10
1D. PRICING	13
1E. EDUCATION AND TRAINING	15
1F. REGULATORY FRAMEWORKS	16
1G. PROJECT HELP INFORMATION	17
SECTION TWO: ENERGY RESOURCE OPTIONS	18
SECTION THREE: PROJECT FINANCING	21
SECTION FOUR: ENERGY EFFICIENCY	39
CHAPTER 4A. THE IMPORTANCE OF ENERGY EFFICIENCY	39
CHAPTER 4B. INDUSTRIAL EFFICIENCY	40
CHAPTER 4C. APPLIANCE EFFICIENCY	71
CHAPTER 4D. BUILDING EFFICIENCY	90
CHAPTER 4E. ROAD TRANSPORTATION EFFICIENCY	107

SECTION FIVE: RENEWABLE ENERGY	128
CHAPTER 5A. THE IMPORTANCE OF RENEWABLE ENERGY.	128
CHAPTER 5B. HYDROELECTRIC ENERGY	158
CHAPTER 5C. SOLAR & WIND	169
CHAPTER 5D. BIOMASS	220
CHAPTER 5E. GEOTHERMAL ENERGY	238
SECTION SIX: RURAL APPLICATIONS	260
SECTION SEVEN: CASE STUDIES	286
CHAPTER 7A. COLOMBIA	286
CHAPTER 7B. PHILIPPINES	298
CHAPTER 7C. PAKISTAN	310
CHAPTER 7D. SOUTH AFRICA	330
CHAPTER 7E. GHANA	340
CHAPTER 7F. KOREA	359
CONCLUSION	370

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DOCUMENTS ON RENEWABLE ENERGY AND ENERGY EFFICIENCY

CHAPTER 4C

Appliance Efficiency

David R. Hodas*

1. INTRODUCTION

The need for electricity in developing countries is enormous, and so is the cost to build traditional electricity generation facilities and their associated infrastructure. The International Energy Agency (IEA) estimates that “1.2 billion people – 17% of the global population – remain without electricity, and 2.7 billion people – 38% of the global population – put their health at risk through reliance on the traditional use of solid biomass for cooking.”¹⁸⁸

The IEA also estimates that the energy sector’s capital needs from 2015 to 2040 will be \$68 trillion, of which \$19.7 trillion will be invested in the power sector and \$21.8 will be invested in end use efficiency.¹⁸⁹ Most of the money will be invested in developed and rapidly developing nations such as China.¹⁹⁰ Given this capital squeeze, particularly in the least developed nations, rational, efficient use of electricity is essential to control electricity demand, reduce greenhouse gas emissions, provide the poor access to electricity and modern energy, and to make most efficient use of resources and capital. Although access to modern energy “plays a strong role in poverty eradication, reducing infant mortality, improving education, ameliorating gender inequality, attaining environmental sustainability, and accelerating global economic growth and prosperity,”¹⁹¹ energy efficiency has the potential to fundamentally reshape and accelerate global efforts to deliver modern energy services to the world’s 4 billion poorest people.¹⁹²

One of the significant uses of electricity is the powering of appliances, equipment and lighting in residential and commercial buildings. Lighting,¹⁹³ refrigerators, computers, clothes washers and dryers,

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188 INTERNATIONAL ENERGY AGENCY, *WORLD ENERGY OUTLOOK 2015*, Exec. Summary 3 (2015).

189 IEA, *WORLD ENERGY OUTLOOK 2015 FACTSHEET: Global energy trends to 2040* (2015)

190 Although this huge investment will expand developing country electrification, especially in Asia, “the ranks of the electricity-deprived ... will continue to swell in Africa,” and 2.6 billion people worldwide will unsustainably rely on traditional biomass fuels for cooking and heating. INTERNATIONAL ENERGY AGENCY, *WORLD ENERGY OUTLOOK 2015* 30, 36 (2015).

191 IEA Executive Director Maria Van der Hoeven in IEA news release, “Universal access to energy would herald enormous economic and social benefits” (14 June 2012)

192 The World Bank, *EA+EE: Enhancing the World Bank’s Energy Access Investments Through Energy Efficiency*, 4 (January 2015)

193 Lighting alone consumes about 20% of electricity globally. Collaborative Labelling and Appliance Standard Program (CLASP), *Energy Policy Toolkit for Energy Efficiency in Appliances, Lighting, and Equipment 1* (2013) (“CLASP S&L Toolkit”)

air conditioners, office equipment, and heating consume huge amounts of electricity.¹⁹⁴ Across the world, “appliance energy use is growing very rapidly and has overtaken water heating as second most important household energy demand.”¹⁹⁵ Although energy growth varies considerably among nations¹⁹⁶ and economic sectors, every nation can improve the energy efficiency of its new stock of electric appliances and commercial equipment, which generally can be done at a cost far lower than building new generation facilities, before incurring the large capital expense and adverse environmental consequences of increased generation capacity.

Great savings¹⁹⁷ and reduced environmental impact¹⁹⁸ from generation can be achieved if all appliances are the most efficient available, and old appliances are replaced with new, more efficient ones. Use of energy efficient appliances continues to expand in the United States with the combination of reinforcing existing policies and encouraging the use of energy efficient appliances, through incentives, such as tax credits.¹⁹⁹ These savings are not unique to highly developed countries, but are ubiquitous.

For example, in the 1980s and 1990s, Ghana’s electricity supply capacity could not keep up with Ghana’s strong economic growth and increased electricity demand. From 1998 to 2000 Ghana’s regular rolling blackouts and its economy suffered. Policy makers turned to appliance standards and labelling to help solve this national crisis and in 2000, Ghana developed the first standards and labelling program in sub-Saharan Africa—first for room air conditioners, and then for compact fluorescent lights (CFLs) and residential refrigerators, saving over USD \$840 million that would otherwise have been invested in new power plants.²⁰⁰

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- 194 Amanda Lowenberger, et al, *The Efficiency Boom: Cashing In on the Savings from Appliance Standards* (American Council for an Energy-Efficient Economy and Appliance Standards Awareness Project Report ASAP8/ACEEE-A123 March 2012) <http://www.appliance-standards.org/sites/default/files/The%20Efficiency%20Boom.pdf>, “Taking into account products sold from the inception of each national standard through 2035, existing standards will net [United States] consumers and businesses more than \$1.1 trillion in savings cumulatively. By 2035, cumulative energy savings will reach more than 200 quads, an amount equal to about two years of total U.S. energy consumption....Standards have had a particularly large effect on electricity use. On an annual basis, products meeting existing standards reduced U.S. electricity use in 2010 by about 280 terawatt-hours (TWh), a 7% reduction. The electricity savings will grow to about 680 TWh in 2025 and 720 TWh in 2035, reducing U.S. electricity consumption by about 14% in each of those years.” The paper analyses the potential U.S. savings from new or updated standards for 34 different types of equipment, and finds that these new standards have the potential to increase energy savings by nearly 50% in 2035, including reduced peak demand of 67 GW and reduced electricity consumption in 2035 of 306 TWh. See Table ES-1.
- 195 IEA, *Worldwide Trends in Energy Use and Efficiency: Key Insights from IEA Indicator Analysis*, 43 (2008).
- 196 Wherever “nation” is used in this chapter, it applies as well to states and municipalities within nations since in many countries states, cities and other municipalities have adopted their own energy efficiency labelling and standards programs.
- 197 “In 2010, existing standards saved 3.4 quads of energy, which is equivalent to about 3.5% of total U.S. annual energy consumption. Existing standards will save more than 200 quads of energy cumulatively through 2035, which is equivalent to about two years of total U.S. energy consumption. The NPV of existing standards is about \$1.1 trillion. ... Net savings from existing standards were about \$27 billion in 2010 and will increase to about \$61 billion in 2025 and \$67 billion in 2035 (in 2010\$)” Amanda Lowenberger, et al, *The Efficiency Boom: Cashing In on the Savings from Appliance Standards* at 3-4. The potential cost savings in the United States from potential new standards through 2035 is estimated to be another \$167 billion (2010 \$) See Table ES-2
- 198 “The CO2 savings from existing [U.S.] standards in 2010 were 203 million metric tons, an amount equal to the CO2 emitted by 51 coal-fired power plants. By 2025, the CO2 savings grow to 448 million metric tons, an amount equal to the emissions of 112 average-sized coal-fired power plants. By 2035, savings increase to 472 million metric tons, the equivalent of 118 coal plant’s CO2 output. CO2 savings can also be compared to the emissions of typical passenger vehicles: 2025 savings will be equal to the emissions of 88 million vehicles and 2035 savings equal to that of 93 million vehicles. Standards have also reduced emissions of other power sector pollutants including nitrogen oxides,” Amanda Lowenberger, et al, *The Efficiency Boom: Cashing In on the Savings from Appliance Standards* at 3 - 6 sulphur dioxide, and mercury,
- 199 International Energy Agency, *World Energy Outlook*, 45 (2015).
- 200 CLASP, *S&L Toolkit* 3

The IEA attributes the continued use of inefficient large appliance use across the world to the lack of implementation of policies and lack of minimum energy performance standards, in addition to, improper labelling and lack of industry wide agreements.²⁰¹ Appliance efficiency labels that accurately inform consumers of anticipated energy use the appliance will require, and appliance efficiency standards that set minimum efficiency requirements for appliances in the marketplace are among the most inexpensive and effective means of improving the efficiency of residential and commercial electricity use.²⁰² Under either approach, government policy makers, at relatively low cost, can establish appliance efficiency performance standards and consumer information requirements (labels), and can monitor compliance and enforce violations. Private manufacturers will innovate and compete within the bounds of government to set ground rules.

Governments also can provide incentives to industry to improve appliance efficiency beyond minimum standards. As greater product efficiency is realized, governments can ratchet up the standards to the higher level achieved by the innovation. This iterative process can transform the market to one that drives substantial efficiency improvements.²⁰³

Globally, both labels and standards have been adopted as valuable tools for setting and implementing national energy efficiency policy. Over 80 nations now have adopted some kind of efficiency and/or labelling requirement, and 55 different product types are now covered by a mandatory standard, with over 3600 different policy measures such as performance standards, and various forms of labelling.²⁰⁴ Seventy-five nations have refrigerator measures, 73 nations regulate air conditioning, 67 countries have lighting measures, and 47 countries have measures for television efficiency.²⁰⁵ These measures have in the long term reduced energy use and costs 3-4% per year everywhere they have been introduced, with much more dramatic savings achieved in nations that had no previous efficiency standards or programs.²⁰⁶ Globally, the national benefits from these programs have exceeded their costs by an average of 3 to 1, a large net savings to society.²⁰⁷ These programs also present a “least cost pathway” for CO₂ emission reductions. Moreover, in many places appliance prices have fallen as products became more efficient, and predictions of price increases associated with appliance efficiency standards have been shown to be off by a factor of 10, which has led the IEA to conclude that because “long-term appliance purchase prices are generally declining in real terms while products are also becoming more efficient,” more ambitious standards are economically justified²⁰⁸

201 IEA, *supra*.

202 Benefits from existing U.S. standards are more than 2,500 times greater than the program costs and represent an overall societal cost-benefit ratio (after the appliances are purchased) of 3 to 1. Standards that were about to take effect in 2001 were estimated to generate benefits worth about 2000 times the program costs. Savings from updating current U.S. standards to reflect efficiency improvement will have an overall cost-benefit ratio nearly as good as the original standards: 2.8 to 1. Energy savings from potential standards in new product categories would enjoy an overall benefit-to-cost ratio of 5 to 1 – far better than the 3 to 1 ratio for existing standards and 2.8 to 1 for updated existing standards. From a government resources perspective, the new standards’ benefits would probably be 1,000 times greater than the government’s costs.

203 Steven Nadel, Jennifer Thorne, Harvey Sachs, Bill Prindle, and R. Neal Elliot, *Market Transformation: Substantial Progress from a Decade of Work* (American Council for an Energy-Efficient Economy April 2003), at <http://aceee.org>.

204 Harrington, L., J. Brown, and M. Caithness, *Energy efficient standards and labelling programs throughout the world in 2013* (May 2014, Energy Efficient Strategies) vi. (This report includes a detailed analysis by nation of every measure adopted or proposed).

205 *Id.* at vii.

206 IEA, *Achievements of appliance energy efficiency standards and labelling programs: a global assessment* (2015) 3

207 *Id.* at 4-5 (Mandatory programs in the U.S. had a 3 to 1 ratio, UK a 3.8 to 1, and a program in Fiji 3.5 to 1. Voluntary programs such as the U.S. Energy Star program produced a \$4.50 saving for every dollar of incremental cost.)

208 *Id.* at 6-7.

Globally, these standards and programs have produced a wide-range of benefits at the individual, sectoral, national and international level. At the individual, household and enterprise level co-benefits include improved health and well-being, poverty alleviation, improved energy affordability and access, and increased disposable income. At the sectoral (industrial, transport, residential, commercial) level, co-benefits include increased industrial productivity and competitiveness, improved energy and other infrastructure benefits, and increased profits and asset values. Nationally, co-benefits include job creation, reduced energy-related public expenditures, energy security, and valuable macroeconomic effects. Internationally, appliance efficiency has resulted in moderating energy prices, reducing natural resource pressure, and promoting the achievement of development goals.²⁰⁹

Examples are plentiful. China's energy efficiency standards and labelling program will eliminate the need for 28 gigawatts of generating capacity by 2020, which will reduce annual emissions of SO₂ by 6.8 million tonnes, NO_x by 4.8 million tonnes, and particulates by 29 million tonnes.²¹⁰ This a remarkable turnaround from China's policy in 1980, when China decided to distribute refrigerators throughout the capital city of Beijing. It did so with resounding success, supplying refrigerators to over 60% of Beijing households by 1990, where only 6% had them in 1980. The reconditioned refrigerators from Japanese factories were thought to be cheap. They were not cheap, however, when the costs of the electric power supply necessary to run these very inefficient machines became apparent. In fact, the purchase and supply of inefficient equipment cost more than three times what would have been the cost of supplying the most efficient refrigerators on the world market [in 1991].²¹¹

After its first year, the Philippines' mandatory standards and labelling program resulted in a 25% increase in average efficiency of all air conditioners, which translates into an energy savings of 6 MW in demand and 17GWh in consumption. Korea, three years into its mandatory standards and labels programs enjoyed an 11% decrease in refrigerator energy consumption and a 24% decrease in air-conditioner energy consumption. Thailand, which instituted a voluntary program, recorded a 14% decrease in refrigerator energy consumption (after 3 years) and a 65 MW decrease in energy demand and a 643 Gwh drop in consumption.²¹²

Despite this progress, there is still much work to be done. Of the 33 Latin American and Caribbean countries, only 13 countries have energy efficiency standards for refrigerators, 12 for air conditioners and 3 for fans.²¹³ If the region implemented standards for refrigerators, air conditioners and fans, it could annually save 138 TWh in energy and about \$20 billion in electricity bills, would help the nations reduce energy subsidies, and would avoid annual emissions of approximately 44 million tonnes of CO₂.²¹⁴

This chapter will offer an overview of the process and issues involved in drafting appliance efficiency and labelling laws, examples of typical legislative language, and references to powerful resources with detailed information, analytical templates and supporting databases for drafting a nation's legislation and regulations.

209 Id. at 10.

210 Id. at 10

211 Richard L. Ottinger, *Energy and Environmental Challenges for Developed and Developing Countries*, 9 PACE ENVTL. L. REV. 55, 59-60 (1991).

212 CLASP Success Stories, <http://clasp.ngo/OurPrograms>

213 CLASP, *Energy Efficient Cooling Products in Latin America and the Caribbean: An Opportunity to Cool Down the Planet and Accelerate the Regional Economy* (2015) 8

214 Id. at 8-10.

II. HELPFUL RESOURCE -- CLASP

Substantial expertise and resources are available to developing countries seeking to engage in this process. Funding is available from national foreign assistance programs, multilateral development banks, regional U.N. Economic Commissions, the Global Environmental Facility, and various private foundations. Most of the expertise and funding is coordinated through the Collaborative Labelling and Appliance Standards Program (CLASP).²¹⁵ CLASP, established in 1999, as an impartial and independent not-for-profit organization dedicated to mitigating energy demand from appliances, lighting, and equipment, is the best resource for any nation considering adopting or revising appliance efficiency standards or labelling laws. CLASP's mission is stated to be as follows: [to develop and share]:

"[P]ractical and transformative policy and market solutions in collaboration with global experts and local stakeholders. We are the leading international resource and voice for energy efficiency standards and labels (S&L) for appliances, lighting, and equipment. Since 1999, CLASP has worked in over 50 countries on 6 continents pursuing every aspect of appliance energy efficiency, from helping structure new policies to evaluating existing programs."²¹⁶

CLASP supports the design, drafting and implementation of efficiency standards and labels in developing and transitional countries through partnerships with agencies, stakeholders and relevant institutions in those countries. CLASP works directly "with policy makers, governments, technical experts, industry, funding organizations, consumers and consumer groups, and others to improve the environmental and energy performance of appliances and related systems we use every day, lessening their impacts on people and the world around us. CLASP convenes stakeholders, conducts analyses, identifies best practices, builds capacity, shares knowledge, guides decision-makers and transforms markets."²¹⁷

CLASP currently works with over 320 partners in over 60 nations and the EU through a variety of programs. Some are nation based, such as in India, China, the EU and the United States. Other programs are subject-based, such as its Global Best Practices and Clean Energy Access programs, as well as its overarching work of providing direct support and technical assistance to all nations seeking the assistance in developing or improving its appliance efficiency. In this regard, CLASP provides "Getting Started" tools for data collection and surveys, an extensive global standards and labelling laws and policies electronic library of all countries. CLASP helps its partners develop monitoring, verification and enforcement programs, and provides a Monitoring, Verification and Enforcement (MVE) Guidebook and electronic library. CLASP also maintains a web-based "Ask the Expert" tool for additional support.²¹⁸

CLASP's "Getting Started" tools are designed to help countries assemble and analyse the data necessary to develop a program. Quality data regarding equipment ownership and use patterns are the technical foundation of the assessment and development of any energy efficiency policy. In particular, standards and labelling programs for residential and commercial products depend on accurate and locally-relevant information at the level of an individual household or commercial enterprise. Residential and commercial survey datasets provide an indication of ownership rates, common product classes, and use patterns for

215 <http://clasp.ngo/WhoWeAre/AboutUs>

216 Id.

217 All of these resources are available at CLASP.ngo.

218 Id.

a variety of products. In addition, they yield market information such as brand, model type and prices paid for common equipment. Recognizing the value of facilitating the collection of quality data for use in standards and labelling programs, CLASP, with the support of the United Nations Foundation, has developed a publicly available set of tools as a resource to program managers and analysts.

There are two survey types provided – residential (RECS) and small business (SBECS). In many countries around the world, small shops, restaurants, offices and other businesses use equipment that is similar to that used in residences for lighting, refrigeration, heating and cooling, and heating water. Therefore, the two surveys have many common elements. Large and specialized commercial equipment are not covered.

The tools provided are (1) a standard printable survey form (2) data entry and collection software and (3) an instruction guide for survey management and implementation. Elements (1) and (2) are combined into a single Microsoft Excel spreadsheet for each survey type. The files are designed such that a printout can be made, constituting an exact hardcopy survey form for use in the field by interviewers. Once data is collected, the same files are used to transfer the collected data efficiently and accurately into a datasheet, which can then be used for analysis. User Instructions are given in Microsoft Word files and provide details of how to use the spreadsheet tools and describe each type of information to be collected. In addition, the User Instructions provide guidance towards the effective implementation of a survey program, including training requirements.

Once this data is collected, “decision makers – including policy makers, funding agencies, and other stakeholders – need to know the potential environmental and financial impacts of any standards and labelling policy under consideration.”²¹⁹ CLASP helps by providing a Policy Analysis Modelling System (PAMS) for estimating the energy savings and monetary costs of implementing local minimum efficiency performance standards. This tool was developed through a decade’s long collaboration with the U. S. Department of Energy’s Lawrence Berkeley National Laboratory. CLASP describes PAMS as “an easy-to-use software tool ... that can be used “out of the box” to estimate costs and benefits of different standards and labelling policies for over 150 countries.” It helps policy makers select strategies that maximize benefits for both consumers and governments. CLASP views PAMS as “an ideal tool for countries with few technical or financial resources.” It also can help more advanced users improve the accuracy of estimates by customizing the tool with any country-specific data that are available.²²⁰

The CLASP website and CLASP support can enable any nation to engage in energy efficiency law reform. The CLASP website describes a law development process that is comprehensive, expert, and straight forward.

CLASP works at the national level to build the skills and institutional capacity necessary to develop, enforce, and maintain standards and labels. National successes help build a critical mass of knowledge, skills, and infrastructure in each region. Participation by multiple countries in the same region begins to have an effect at the regional and international levels through effects on cross border trade flows. To achieve this outcome, CLASP devotes about 70% of its resources to national assistance, about 20% to regional alignment/harmonization projects, and about 10% to building

219 Id.

220 <http://clasp.ngo/Tools/Tools/PolicyAnalysisModelingSystem>

partnerships and creating tools such as its web site to facilitate the national and regional projects.

CLASP projects build upon existing initiatives in any country to promote the cost-effective adoption and implementation of energy efficiency standards and labels. CLASP's objective is to transform the manufacture and sale of energy consuming products to higher levels of energy efficiency, thereby presenting an opportunity for all countries in the region to grow in a more environmentally sustainable and economically efficient manner. CLASP projects often focus on regional markets. Due to its overwhelming success, CLASP now works together with "policy makers, governments, technical experts, industry, funding organizations, consumers and consumer groups" to promote energy efficiency through laws and initiatives.²²¹

CLASP provides assistance in any or all of the following seven process-oriented steps in standard-setting or labelling program implementation, including: 1) deciding whether and how to implement energy efficiency standards and labels (appropriate products, priorities, timing); 2) developing a testing capability; 3) designing and implementing a labelling program, encompassing consumer, manufacturer, and retailer outreach; 4) analysing and setting standards; 5) involving all stakeholders at a country and regional level, including industry, NGOs and consumers; 6) maintaining and enforcing compliance, and 7) evaluating the labelling and standards-setting program to demonstrate overall effectiveness and to determine opportunities for upgrade and improvement.

CLASP designs its projects to facilitate exchanges among governments, industry, inter-governmental organizations, and technical support groups based on the concept of linking assistance providers and assistance recipients in partnerships with shared responsibilities. It facilitates the participation of stakeholders with global and national expertise in energy efficiency standard-setting and labelling and builds upon previous successful experiences worldwide to implement any S&L program. CLASP's basic approach is to assist project stakeholders in defining and performing their appropriate roles, rather than performing any basic functions on their behalf. Fundamentally, all the activities can be classified as capacity building.

Experience suggests that inefficient appliance and equipment technology often becomes available to developing countries (low entry costs, little copyright protection) from new-entrant local suppliers no longer able to sell inefficient products in developed countries.

CLASP projects seek to strike the most appropriate balance among the sometimes competing objectives of:

- providing and stimulating the use of highly efficient products;
- supporting local manufacturers; and
- ensuring that consumers have the capacity within the context of the local industrial, economic and energy infrastructure to afford efficient technology.

221 <http://clasp.ngo/WhoWeAre/What%20We%20Do>

III. STANDARDS AND LABELLING DRAFTING CONSIDERATIONS

A. How Does One Decide Whether to Adopt Standards and/or Labelling Programs?

Appliance energy efficiency and labelling programs generally use two different techniques, energy efficiency labels and energy efficiency standards, either separately or combined.²²²

Label designs can take varying approaches, such as endorsements, certifications, product comparisons, and product energy usage. No matter the form, all labels are designed to inform consumer choice at the time of purchase. The labels do not mandate how efficient a product must be. Instead, label programs seek to provide consumers with energy efficiency and lifecycle cost information to encourage market choices to purchase energy efficient appliances. To the extent accurate energy efficiency and lifecycle cost information is conveyed by labels to the purchaser, consumer choice will be tilted towards more efficient products and manufacturers will be induced to make and market more efficient appliances.

In contrast to labels, energy efficiency standards set specific, minimum energy performance requirements for products and classes of products. Whichever approach, or combination of approaches used, the government must decide whether to make them mandatory or voluntary.

The first step in the decision process is for the government to decide whether it should use labels or standards, or both, and if so, which approaches would be best for the country. The policy maker must also decide whether the program will be mandatory or voluntary. This first step is critical to the success of any program. It is analytically challenging and requires the availability of a broad range of valid, reliable data. The policy maker must assess the nation's institutional, economic, legal, and cultural capacity to develop and implement a program, must determine if there is adequate political support for the effort, must quantify the economic and environmental costs and benefits of an appliance efficiency program, and must estimate the effect of a program on consumer preference.

Example of a statutory energy efficiency policy statement:

To begin, the policy maker must assemble the data on and evaluate: a) the current and potential efficiency of different appliances that are or will be available in the market, b) whether the products are or could be domestically produced or must be imported, and c) the kinds of standards other countries have adopted. CLASP is an important resource for this step. This information must be combined with the evaluation of the nation's needs and institutional capacity to determine what range of products should be covered by the efficiency program (e.g., refrigerators, lighting, air conditioning, freezers, computers, etc.), what kind of regulation (label or standard) would work best for each covered product category, and the anticipated costs and benefits of each approach in order to determine the kind, scope and stringency of policy that should be adopted. The end

222 The overview that follows in this and later sections of the chapter are, unless otherwise specifically noted, taken from STEPHEN WEIL & JAMES E. MCMAHON, EDS., ENERGY-EFFICIENCY LABELS AND STANDARDS: A GUIDEBOOK FOR APPLIANCES, EQUIPMENT AND LIGHTING, 2ED. (CLASP February 2005), the CLASP web site, <http://clasp.ngo/Resources/Resources/PublicationLibrary/2000-and-earlier/Supporting-network-for-EESL-in-developing-countries> ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC, ENERGY EFFICIENCY: COMPENDIUM OF ENERGY CONSERVATION LEGISLATION IN COUNTRIES OF THE ASIA AND PACIFIC REGION (UNITED NATIONS 1999), AND INTERNATIONAL ENERGY AGENCY, ENERGY STANDARDS AND LABELS (OECD/IEA 2000), <http://www.unescap.org/publications>

JAPAN: The Rational Use of Energy Law

Chapter 1, Objectives, Article 1.

This law's purpose is to contribute to the sound development of the national economy through implementing necessary measures for the rational use of energy in factories, buildings, and machinery and equipment, and other necessary measures to promote comprehensively the rational use of energy in order to ensure the effective use of fuel resources that would meet the economic and social environment of energy at home and abroad.

Chapter 1-2. Fundamental Policies, etc., Article 3.

1. The Minister of Economy, Trade and Industry shall determine and make public Fundamental Policies ... for the purpose of promoting comprehensively the rational use of energy at a factory, business premise,...

2. The Fundamental Policies shall, in order to rationalize the use of energy, define... measures to be implemented by energy users, policies to promote the rational use of energy...in consideration of a long-term outlook of energy supply and demand, technical level for the rational use of energy or other circumstances.

Full text at <http://www.asiaeec-col.eccj.or.jp/index.html> Additional useful information and data on energy efficiency in Japan is available from Japan's Agency for Natural Resources and Energy, www.enecho.meti.go.jp.

product of this analytical process will be the decision whether to adopt a program, and if so, the kind, scope and stringency of the policy that should be adopted.

B. What Testing Capability is Needed for a Standards and/or Labelling Program?

The next critical requirement is that the nation be able to determine whether a product complies with the proposed standard and whether the label's claims are accurate. Thus, it is essential that the country establish or obtain access to a qualified testing centre for evaluating the energy efficiency of products and label claims. Both standards and label requirements must be supported by protocols for product energy efficiency testing in order to standardize measurement of a product's energy use and efficiency and to standardize the efficiency information on labels. The nation could set up its own centre, join with other nations to run a regional centre, or contract with an existing facility for the services. This testing capability is essential for program legitimacy and effectiveness, both when establishing the regulatory requirements and in insuring compliance. Also, the testing protocols and protocols for product certification by industry must be publicly promulgated, so both industry and the testing centre can reliably and comparably evaluate product performance and market compliance. Additionally, manufacturers relying on private testing for certification, must establish that testing procedures are accredited and valid.

An example from Canada of legal authority for product testing and data reporting follows:

EXAMPLE OF LEGAL AUTHORITY FOR PRODUCT TESTING AND DATA REPORTING

Canada: Energy Efficiency Act - 1992, c. 36

Requirements to supply test products

(1) The Minister may require any dealer who ships or imports energy-using products as described in subsection 4(1) to make available, at such place as the Minister may specify, such number of those products as the Minister considers to be reasonably necessary for examination and testing under this section, and the dealer shall forthwith comply with the request.

Testing

(2) The Minister may dismantle and examine any energy-using product made available pursuant to subsection (1) and may conduct such tests on it as the Minister considers to be reasonably necessary to determine the product's energy efficiency.

Outside testing

(3) The Minister may enter into an agreement or other arrangement with any person for the examination and testing of energy-using products under this section.

Source: <http://laws-lois.justice.gc.ca/eng/acts/e-6.4/page-1.html#h-6>

Statistics- Regulations –

22. The Governor in Council may make regulations requiring prescribed persons to file with the Minister, in the prescribed form and manner, at the prescribed time and for each prescribed reporting period, a report setting out prescribed statistics and information respecting

(a) the value, quantity, type and use of energy, including alternative energy, purchased, consumed or sold by that person;

(b) the expenditures of that person on the research, development, acquisition and operation of energy-using equipment and related technology; and

(c) the sales of prescribed energy-using products or classes of energy-using products by that person, including the revenue from, and geographic distribution of, the sales.

Source: <http://laws-lois.justice.gc.ca/eng/acts/e-6.4/>

Availability of technical expertise and testing capability is also essential in designing standards and labels. In choosing a testing standard, the nation must decide what kind of data is most valuable to assess energy efficiency. It could include a range of measures, such as how much energy does the product use overall, and in performing different aspects of its tasks. The analysis must also consider how much variability in energy consumption and efficiency will be acceptable for a product to meet applicable standards or labelling requirements, how much variability in the test method itself is acceptable, and how much all this testing will cost.

An example from Egypt follows:

Egypt. - The Ministry of Electricity and Energy is setting up an energy efficient equipment laboratory as part of its Energy Efficiency Improvement project; the laboratory is funded jointly by the Egyptian Government, UNDP and Global Environment Facility. The laboratory will be an important tool in Egypt's efforts to reduce energy consumption, and will provide "teeth" to Egypt's recently adopted energy efficiency standards for refrigerators, washing machines and air conditioners. The laboratory will enable Egypt to verify energy consumption levels of imported and locally made electrical appliances, and to monitor compliance with energy efficiency standards.

Source: www.clasp.ngo/OLD%20ITEMS/PastProgramLocations/Egypt; http://www.thegef.org/gef/sites/thegef.org/files/gef_prj_docs/GEFProjectDocuments/MandE/TER/FY2010/UNDP/267/267_452_TE_CCM_Egypt.pdf; https://info.undp.org/docs/pdc/Documents/EGY/00060162_Final%20Draft%20-%20Project%20Document.pdf; www.un.org/esa/sustdev/sdissues/energy/etb_newsletter/etbnewsletter_dec01.pdf

C. What factors must be considered in designing standards and labelling efficiency programs?

Once a nation has decided to adopt a standards or label program it must establish adequate legal authority for and then set about to design a specific label and set particular product efficiency standards.²²³

Examples of relevant Canadian statutory and regulatory language follows:

²²³ CLASP maintains an extensive, searchable label design library with 326 different labels. The site displays each label, which can be sorted by country, label type, or product; it also maintains links to each program. It is located at www.clasp.ngo/en/Tools/Tools/SL/Search_and and www.clasp.ngo/Tools/Tools/EconomyFinder. Another extensive database and important resource is maintained by the Asia-Pacific Economic Cooperation (APEC) Energy Standards and Labelling Program. The APEC Energy Standards Information System (ESIS) is a new APEC-funded initiative to develop a comprehensive web site on testing standards, MEPS, and labelling requirements for countries in the Asia-Pacific region. Information can be found at www.apec-esis.org/

CANADIAN EXCERPS FROM THE LEGAL AUTHORITY FOR A STANDARDS AND DESIGN PROGRAM

Canada, Energy Efficiency Act - 1992, c. 36

Trade in Energy-Using Products Interprovincial trade and importation

4. (1) No dealer shall, for the purpose of sale or lease, ship an energy-using product from ..., or import an energy-using product into Canada, unless

- (a) the product complies with the energy efficiency standard; and
- (b) the product or its package is labelled in the prescribed form...

Tampering with label

No person shall, before an energy-using product is sold to the first retail purchaser or leased to the first lessee, remove, deface, obscure or alter any label put on the product or its package in accordance with the regulations.

Regulations

20. (1) The Governor in Council may make regulations

- (a) prescribing as an energy-using product any manufactured product designed to operate using electricity, oil, natural gas or any other form or source of energy or to be used as a door system or window system;
- (b) prescribing energy efficiency standards for energy-using products or prescribed classes of energy-using products;
- (c) prescribing the form and manner of labelling energy-using products or their packages or prescribed classes of energy-using products or their packages with respect to the products' energy efficiency;
- (d) providing for the testing of energy-using products to determine their energy efficiency; ...

Source: www.laws-lois.justice.gc.ca/eng/acts/e-6.4/FullText.html

D. What are the Label Design Considerations?

A label can simply provide an endorsement or seal of approval from a certified program, either public or private. The U.S. EPA and Department of Energy ENERGY STAR® label is an excellent example of an endorsement label.²²⁴ Other nations that use endorsement labels include Australia, Brazil, China, European Union (some EU countries, such as Germany, Great Britain, The Netherlands, Austria, Spain and Poland, also have their own endorsement label), India, Japan, Korea, Mexico, New Zealand, Singapore, Switzerland, and Thailand.²²⁵ Endorsement labels generally display a

224 For detailed information see www.energystar.gov (United States), and www.eu-energystar.org / (European Union Energy Star),

225 Compiled from data reported by Lloyd Harrington of Energy Efficient Strategies in the 1990s and the 2013 report prepared by Jack Brown of Energy Efficient Strategies and Marg Caithness of Maia Consulting ENERGY LABELLING AND STANDARDS PROGRAMS THROUGHOUT THE WORLD IN 2013, supra note 25, and by the CLASP label design library, supra note 32.

seal of approval that provides no specific energy use data to the consumer, but instead represents the endorser's assurance that the product meets some level (hopefully high) of performance, either in absolute terms or in relative terms, such as identifying products that perform at the top 10% of all products of that type on the market.

The value of the endorsement label is directly related to the credibility of the endorser to the purchaser. Hence, the U.S. and International Energy Star label, all of which are government issued, has been very effective. However, as the variety of endorsements and endorsers expands, and endorsements compete with each other, seals of approval labels become confusing to consumers and lose their power to influence consumer choice. On the other hand, one of the major strengths of endorsement labels is that they are easy for the consumer to read because they contain little or no statistical information. An example follows:

EXAMPLE OF LAW ESTABLISHING A LABELING PROGRAM

European Union: Energy labelling of household appliances, (EC) reg. No. 2422/2001

The Directive applies to refrigerators, freezers and their combinations; washing machines, dryers and their combinations; dishwashers; ovens; water heaters and hot-water storage appliances; lighting sources; and air-conditioning appliances...

Household appliances offered for sale, hire or hire-purchase must be accompanied by a fiche and a label providing information relating to their consumption of energy (electrical or other) or of other essential resources. Where appliances are offered for sale, hire or hire-purchase by catalogue or by other means whereby the potential customer is unable to see the appliance displayed, the essential information contained in the label or fiche must be provided to the potential customer before purchase.

The supplier must establish, and make available, technical documentation sufficient to enable the accuracy of the information contained in the label and the fiche to be assessed. This documentation must include: a general description of the product; the results of design calculations, where necessary; test reports; and where values are derived from those obtained for similar models, the same information for these models...

Suppliers must provide:

- a free label, to be attached to the appliance by the dealer in the appropriate position and in the appropriate language version;
- a product fiche, contained in all the brochures relating to the product or, where these are not provided, in all other literature provided with the appliance...

Member States must take the necessary measures to:

- ensure that all suppliers and dealers established in their territory fulfil their obligations under this Directive;
- prohibit the display of labels, marks, symbols or inscriptions relating to energy consumption which do not comply with the requirements of this Directive and which are likely to cause confusion, with the exception of Community or national environmental labels;...

The Directives adopted in implementation of the present Directive must specify:

- the exact definition of the type of appliances to be included;

- the measurement standards and methods to be used in obtaining the information relating to energy consumption;
- details of the technical documentation required;
- the design and content of the label;
- the location where the label shall be fixed to the appliance;
- the content and where appropriate the format of the fiche, on which must be included the information appearing on the label;
- the information details to be provided in the case of mail-order offers for sale.

Source: <http://laws-lois.justice.gc.ca/eng/acts/e-6.4/>

The label can provide a qualitative rating, specific performance data, or comparative information for consumers. Comparison labels contain various types of energy information, qualitative or quantitative, that can be used to compare products in a category. Examples of comprehensive product comparison label are those mandated in the European Community, Argentina, Australia, Brazil, China, Colombia, Hong Kong (China), Hungary, India, Indonesia, Iran, Israel, Malaysia, Mexico, Sri Lanka, Switzerland, Thailand, and United States.²²⁶

Comparison labels provide more consumer information than endorsements, but are less easily readable. Countries such as Canada, the U.S., Israel, Jamaica, Japan, Malaysia, Mexico, Indonesia, Russia, Singapore, and Sri Lanka use a label that rates appliances on a continuous scale.²²⁷ Information only labels provide a high level of information but sacrifice readability and ease of product comparison. Information only labels are used in Costa Rica, Mexico, Indonesia and Philippines.²²⁸ These provide energy consumption, efficiency ratings and operating costs for the product only, leaving it up to the consumer to gather and compare data on other products on the market.

Label design can vary within a country from product category to category; countries may make labels mandatory for one product category but leave them voluntary in another category. The particular approach and actual design of labels should be the one that best suits the nation's economic, social, and cultural factors, and should also consider the need to harmonize the label with that required by other nations in the region and with the requirements of the countries where the products are manufactured.

226 Id.
227 Id.
228 Id.

EXAMPLE OF LAW ESTABLISHING A LABELING PROGRAM

European Union: Energy labelling of household appliances, (EC) reg. No. 2422/2001

The Directive applies to refrigerators, freezers and their combinations; washing machines, dryers and their combinations; dishwashers; ovens; water heaters and hot-water storage appliances; lighting sources; and air-conditioning appliances...

Household appliances offered for sale, hire or hire-purchase must be accompanied by a fiche and a label providing information relating to their consumption of energy (electrical or other) or of other essential resources. Where appliances are offered for sale, hire or hire-purchase by catalogue or by other means whereby the potential customer is unable to see the appliance displayed, the essential information contained in the label or fiche must be provided to the potential customer before purchase.

The supplier must establish, and make available, technical documentation sufficient to enable the accuracy of the information contained in the label and the fiche to be assessed. This documentation must include: a general description of the product; the results of design calculations, where necessary; test reports; and where values are derived from those obtained for similar models, the same information for these models...

Suppliers must provide:

- a free label, to be attached to the appliance by the dealer in the appropriate position and in the appropriate language version;
- a product fiche, contained in all the brochures relating to the product or, where these are not provided, in all other literature provided with the appliance...

Member States must take the necessary measures to:

- ensure that all suppliers and dealers established in their territory fulfil their obligations under this Directive;
- prohibit the display of labels, marks, symbols or inscriptions relating to energy consumption which do not comply with the requirements of this Directive and which are likely to cause confusion, with the exception of Community or national environmental labels;...

The Directives adopted in implementation of the present Directive must specify:

- the exact definition of the type of appliances to be included;
- the measurement standards and methods to be used in obtaining the information relating to energy consumption;
- details of the technical documentation required;
- the design and content of the label;
- the location where the label shall be fixed to the appliance;
- the content and where appropriate the format of the fiche, on which must be included the information appearing on the label;
- the information details to be provided in the case of mail-order offers for sale.

Source: <http://laws-lois.justice.gc.ca/eng/acts/e-6.4/>

E. What are Considerations for Drafting Design Standards?

Standards set product performance criteria that manufacturers must achieve. Standards can be designed to eliminate the least efficient products from the market, eliminate all but the most efficient products from the market, to harmonize with other nations' standards, or to encourage local manufacturers to make, or local importers to import and sell, products more efficient than those that merely meet the minimum standards. In making these decisions, policy makers need to make an engineering analysis, a national impact analysis, a consumer analysis, and a manufacturing analysis.²²⁹

- The engineering analysis evaluates the energy efficiency of products sold in the country and determines both the technical feasibility and cost of improving the products' efficiency, and also considers how the efficiency improvements will affect the products' overall performance.
- The national impact analysis examines the specific proposed standard's potential social costs and benefits, the impact reduced energy consumption would have on local utilities, and the environmental benefits and possible adverse effects the standard's reduced energy consumption might cause.
- The consumer analysis evaluates the standards' economic impact on a consumer's purchase decision.
- Finally, the manufacturing analysis evaluates the effect of the standard on domestic and international manufacturers, suppliers, importers, employers, and retailers.

In considering this information, whether for label design or standard setting, it is important that all stakeholders be involved, both to establish political credibility, legitimacy, and support for the proposed standard, and to insure that the data and analysis do not ignore key factors, or reflect analytical mistakes. Stakeholders should include community leaders, government officials, legislators, manufacturers, importers, retailers, consumers, energy suppliers, and environmental interests.

The result of this public deliberative process should be substantial consensus on measures that best meet the social, economic, political, and environmental needs of the communities and nation, and fit their scientific and technical capability. Policy makers must also consider what the communities and nation must do to develop adequate institutional capability for the program, what legal authority will be necessary, how and what kind of monitoring capacity they have and will need, how they will inform those regulated of the new mandates, and their capacity to assist those regulated to achieve compliance. Lessons from other nations can be extremely valuable in this endeavour. Finally, the policy makers must evaluate how to develop the capacity to assess the program's actual impacts, its successes and failures, to learn from these lessons, and to use this learning to fix and improve the program. Some examples follow:

229 Weil and McMahon, CLASP GUIDEBOOK, 23, *supra* note 29

Examples of Standards Programs in Developing Countries

Ghana. Ghana's Electrical Appliance Labelling and Standards Programme (GEALSP) has set a mandatory minimum standard for air conditioners; it is test standard GS362 (2001) which uses as a reference standard ISO 5151. The implementing entity for this standard is the Ghana Energy Foundation. The Ghana Energy Foundation is a non-profit, public-private partnership institution devoted to the promotion of energy efficiency and renewable energy as a key strategy to Ghana's growing energy needs in a sustainable manner. It was established in November 1997, by the Private Enterprise Foundation in collaboration with the Government of Ghana, energy sector stakeholders and private sector energy consumer.

Egypt. In 2003, the Egyptian Organization for Standardization approved Energy Efficiency Standards Specifications for refrigerators, washing machines and air conditioners. A Ministerial decree requires that manufacturers and importers comply with this standard and label electrical appliances with energy consumption data about the appliance.

Source: www.clasp.ngo

IV. WHAT ASSISTANCE CAN THE CLASP GUIDEBOOK AND OTHER RESOURCES PROVIDE?

The process described above reflects an overview of the general procedures for establishing energy efficiency labelling and standards requirements. It has been taken largely from the CLASP Guidebook that elaborates on each step, with special consideration given to the special challenges facing developing countries. Written by experts from around the world who have extensive experience in helping developing nations develop energy efficiency and label programs, it is an invaluable resource for the process. It details, chapter by chapter, every aspect of the steps described above. It is, in the authors' words, "a manual for government officials and others around the world for designing, implementing, enforcing, monitoring and maintaining labelling and standard-setting programs. It discusses the pros and cons of adapting energy-efficiency labels and standards and describes the data, facilities, and institutional and human resources needed for these programs. It provides guidance on the design, development, implementation, maintenance, and evaluation of the programs and on the design of the labels and standards themselves." It is available free from CLASP at www.clasp.ngo/en/Resources/Resources/StandardsLabelsGuidebook.

Another valuable resource for those interested in developing a label or standards program is the Energy Efficiency: Compendium of Energy Conservation Legislation in Countries of the Asia and Pacific Region (United Nations 1999) by the Economic and Social Commission for Asia and the Pacific. It contains articles that discuss general considerations for a label or standards program, and that describe the regulatory programs in Australia, Japan, Korea, the Philippines and Thailand. Additionally, it contains examples of energy labels and extensive portions of the relevant laws in Australia, China, Japan, Republic of Korea, the Russian Federation, Thailand, the U.S., and Uzbekistan.

Extensive resources are available on the internet. Among the most useful web sites are:

- Collaborative Labelling and Appliance Standards Program (CLASP), www.clasp.ngo.
- APEC Energy Standards Information Systems www.apec-esis.org.
- AFREPREN/FWD Energy, Environment and Development Network for Africa. www.afrepren.org/.
- Alliance to Save Energy - www.ase.org/.
- American Council for an Energy-Efficient Economy (ACEEE), www.aceee.org.
- Appliance Standards Awareness Project www.appliance-standards.org.
- Energy Efficient Strategies, Australia, www.energyefficient.com.au and www.energyrating.gov.au.
- Energy Star, U.S, www.energystar.gov.
- ECOWAS Observatory for Renewable Energy and Energy Efficiency, www.ecowrex.org
- Global Lighting and Energy Access Partnership (Global LEAP) <http://www.cleanenergyministerial.org/Our-Work/Initiatives/Energy-Access>.
- International Energy Agency, www.iea.org.
- International Energy Agency 4E Energy Efficient End Use Equipment Program <http://www.iea-4e.org/about-4e>.
- International Institute for Energy Conservation, www.iiec.org/.
- U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy www.eere.energy.gov.
- Berkley Lab Energy Technologies Area, <http://eetd.lbl.gov>.
- Capacity Building Project in Energy Efficiency and Renewable Energy (CaBEERE) (a joint project of South Africa and Denmark) - <http://www.energy.gov.za/EEE/Projects/Appliance%20Labelling/Information%20Campaign%202005/ANNEX%20D%20CaBEERE%20Backgrounder.pdf>.
- India Bureau of Energy Efficiency, www.beeindia.gov.in.
- Natural Resources Canada Office of Energy Efficiency (OEE), <http://www.nrcan.gc.ca/energy/offices-labs/office-energy-efficiency>.
- Renewable Energy and Energy Efficiency Partnership, www.reeep.org.
- Observatory for Renewable Energy in Latin America and the Caribbean, <http://www.renergyobservatory.org>.
- Brasil Secretaria de Estado do Meio Ambiente, www.ambiente.sp.gov.br.

VI. CONCLUSION

Appliance energy efficiency standards and label programs are among the most cost effective, durable, and rapidly accessible means to achieve efficient use of electricity. Every KWh of electricity saved by a more efficient appliance is a KWh that is available for other uses, or is a KWh that need not be generated. These savings reduce the need to invest in additional generating capacity, and allow available electricity to be used more effectively.

With enormous capital needs in all sectors, such savings are invaluable. Moreover, in the developing world, where someone and a half billion people still lack access to electricity, it is imperative that every KWh of electricity be used as efficiently as possible, so it can benefit as many people as possible. Particularly as applied to new investment in electricity-using products, efficiency standards and labels can realize substantial energy savings at remarkably low cost. The savings from standards and label programs can also reduce the burning of polluting fuels, saving both fuel costs and the health and environmental costs of the otherwise unnecessary electricity generation.

At initial glance, the notion of developing and implementing a standards or labelling program might seem daunting. However, that is not the case. Rather, because these programs are so cost effective, an impressive array of organizations have combined efforts to make the process of program development and implementation relatively easy and inexpensive.

This chapter has outlined the range of issues that must be addressed in establishing an energy efficiency standards or label program, has pointed to some of the many examples of successful effort, and has provided reference to the extensive resources that are available to support any program. In particular, CLASP and APEC-ISIS provide access to expertise and support to any developing nation that wishes to adopt a program.