DEVELOPMENT OF A COMPARATIVE ANALYSIS OF ENERGY EFFICIENCY STANDARDS IN RESIDENTIAL, COMMERCIAL AND PUBLIC BUILDINGS IN LATIN AMERICA AND THE CARIBBEAN

FUNDACIÓN BARILOCHE

Executive Summary

July 12, 2017

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

Many countries in the Latin America and the Caribbean (LAC) region are developing and implementing energy efficiency (EE) policies and strategies as an efficient way to meet energy challenges both at the supply and demand levels, and to fulfill their commitments in the fight against climate change.

Codes, guidelines, standards, labelling programs and EE regulations are appropriate tools to facilitate the development of such policies and strategies, whose objective is to contribute to saving energy and reducing greenhouse gases (GHGs) by introducing and marketing energy-efficient equipment in local markets, and by barring inefficient equipment from those markets.

Various methods exist to develop and implement those tools; good practices are well documented in the reference material of organizations such as CLASP[1], the International Energy Agency (IEA)[2] and the Inter-American Development Bank (IDB)[3].

Background

The project *Climate Technology Transfer Mechanisms and Networks in LAC* is currently being developed with financial support from the Global Environment Facility (GEF), in turn managed by the IDB and implemented by Argentina's Fundación Bariloche.

For this project, the Fundación Bariloche contracted Econoler to "*develop a comparative analysis of energy efficiency standards for residential, commercial and public buildings in the main countries of Latin America and the Caribbean*" in order to identity best practices and promote the harmonization of standards in the region as well as generate information that could contribute to adopting public policies for the better management of energy in residential, commercial and public buildings.

The study included comparing the situations and subject matter expertise of 10 LAC countries: Argentina, Brazil, Colombia, Costa Rica, Jamaica, Mexico, Panama, Peru, the Dominican Republic and Uruguay.

The study further sought to compare the minimum energy efficiency standards related to items which have an impact on energy use in residential, commercial and public buildings, among them the building envelope (thermal insulation, building materials, colors, envelope control systems, windows, etc.), lighting equipment, air-conditioning systems, refrigerators and freezers, other appliances, water heaters, small motors, etc.

Comparative Analysis of the Energy Contexts

First, the energy contexts in which those standards were developed as well as the institutional and regulatory frameworks supporting the implementation of such standards were compared. Each of the ten countries selected for this study has a different development level, with significant contrasts in energy, economic, institutional and regulatory matters.

Since EE standards mostly affect electrical appliances, observing the electrical matrix rather than the energy matrix of the selected countries has proven to be more relevant. As far as sources of energy production are concerned, the average ratio between renewable and non-renewable sources among all ten countries is 1, meaning that 50% of the sources are renewable and 50% are non-renewable sources. As shown in the figure below, countries with a higher ratio of renewable

[1] http://clasp.ngo/en/Resources/Resources/PublicationLibrary/2005/SL-Guidebook-English
[2] https://www.iea.org/publications/freepublications/publication/EEPolicyRecom_LatinAmerica_Caribbean.pdf
[3] Guía E: Programas de normalización y etiquetado de eficiencia energética: https://publications.iadb.org/handle/11319/7326 [in Spanish only]

energy sources, such as Brazil, Costa Rica, Colombia and Uruguay, also have lower grid emission factors[4] than countries dominated by non-renewable energy sources, such as Argentina, Jamaica, Mexico and the Dominican Republic. Uruguay would be an exception given the recent change in the electrical matrix and the missing data on the grid emission factor to this day.

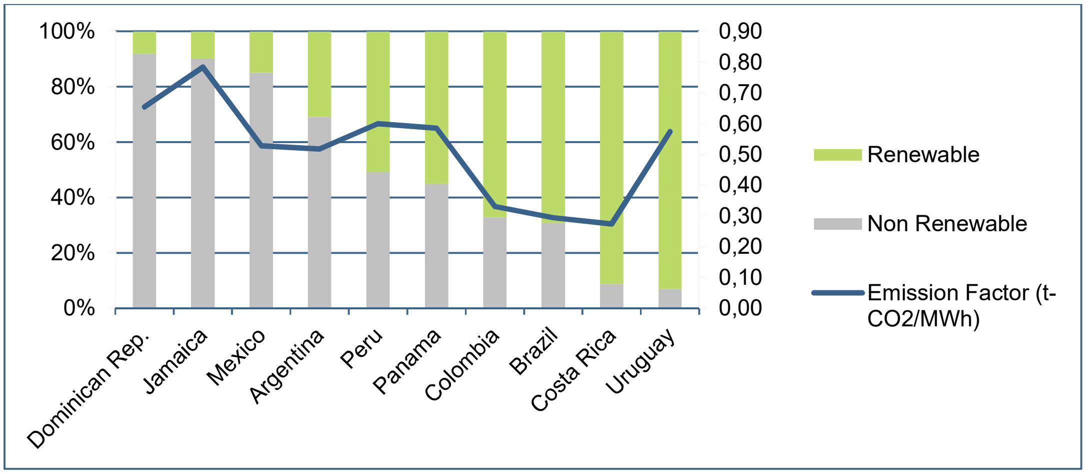

Figure 1: Proportion of Renewable Sources in Electricity Production and Power Grid Emission Factor[5]

Furthermore, the residential, commercial and public building sectors make up on average 60% of the energy use in the selected countries, as shown in the figure below.

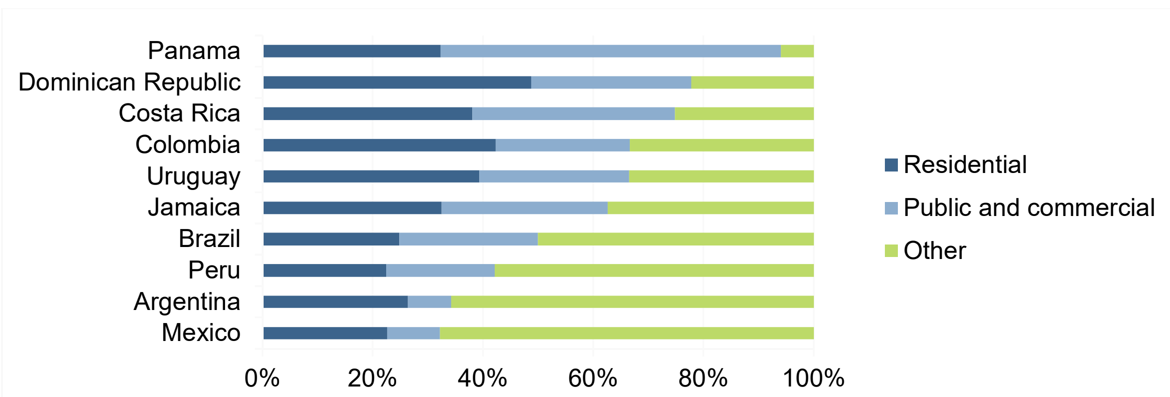

Figure 2: Proportion in Energy Use of the Residential, Commercial and Public Sectors of the Countries Studied[6]

Large discrepancies were observed in the electricity consumption of select sectors in each country. These discrepancies are closely linked to their economies. For instance, the services sector in Panama—the most dominant sector of its economy—accounts for 65% of the electricity consumption. The consumption of this sector is brought down to less than 35% in both Mexico and Argentina, where the industrial sector is stronger. This certainly has to do with the fact that subsidies applied to electricity rates in this sector are high in both Argentina and Mexico, as shown in the figure below.

[4] List of Grid Emission Factors from the Institute for Global Environmental Strategies (IGES). http://pub.iges.or.jp/modules/envirolib/view.php?docid=2136

[5] Prepared by the authors of the report based on the most recent energy balances of each country. Details can be found in the report.

[6] Prepared by the authors of the report based on the most recent energy balances of each country. Details can be found in the report.

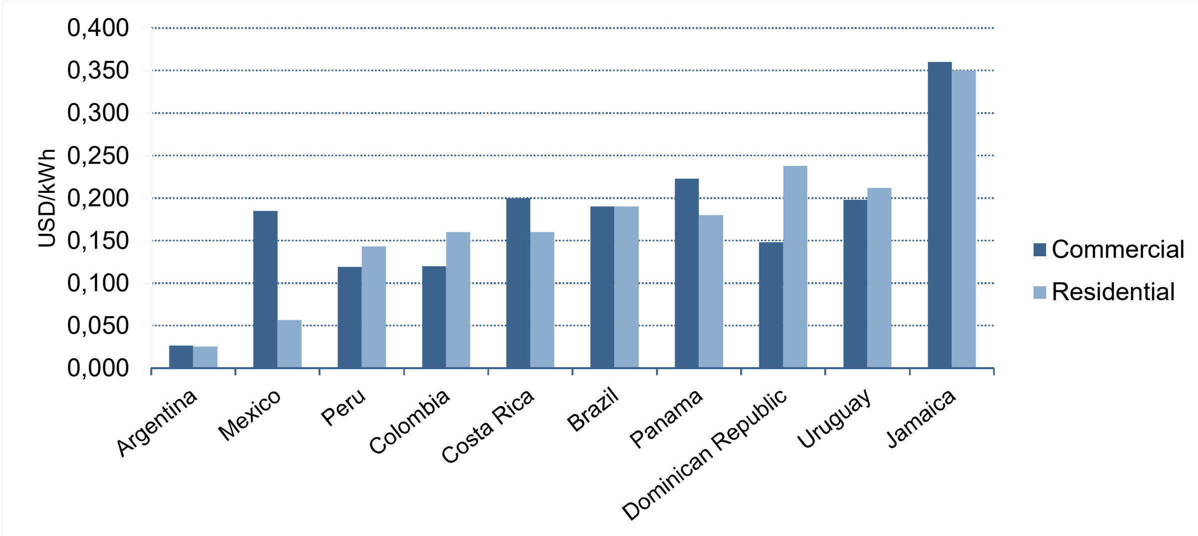

Figure 3: Electricity Rate in USD/kWh in the Countries Studied[6]

Subsidies for electricity rates also exist in Argentina for residential, commercial and public tariffs. The higher the rates, the shorter are the payback periods in EE projects. There is no direct correlation, however, between rates and EE initiatives in the selected countries since rates faithfully representing market costs for energy availability are indeed an essential condition, though not enough to launch EE initiatives. For example, Jamaica has implemented very few EE initiatives or programs, despite having one of the highest electricity rates in the region.

Energy Intensity

The higher is the energy intensity value, the greater is the amount of energy used to generate one unit of GDP in the country. The following map shows how variable energy intensity can be among the selected countries.

Figure 4: Energy Intensity in the Countries Studied[7]

---

7 http://databank.bancomundial.org/data/reports.aspx?source=Indicadores%20del%20desarrollo%20mundial&preview=on&l=es#

Energy End-uses

Knowing the main end-uses of electricity and fuels—especially fossil fuels—can guide governments in implementing EE initiatives, more specifically in areas where more significant and cost-efficient results can be obtained. It must be noted that there is little recent information available about energy end-uses in the sectors reviewed of the selected countries.

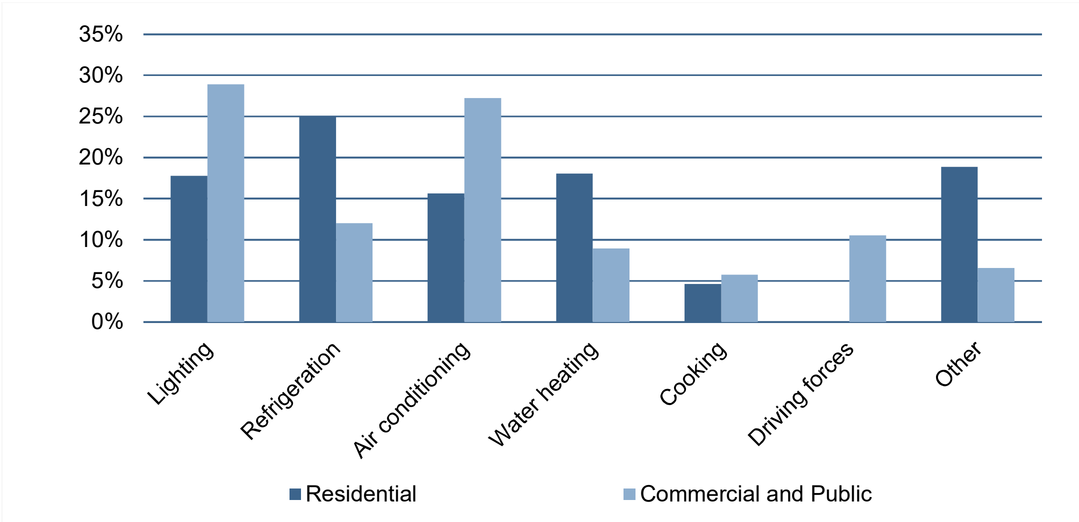

Figure 5: Average End-uses of Electricity in the Residential, Commercial and Public Sectors of the Countries Studied[8]

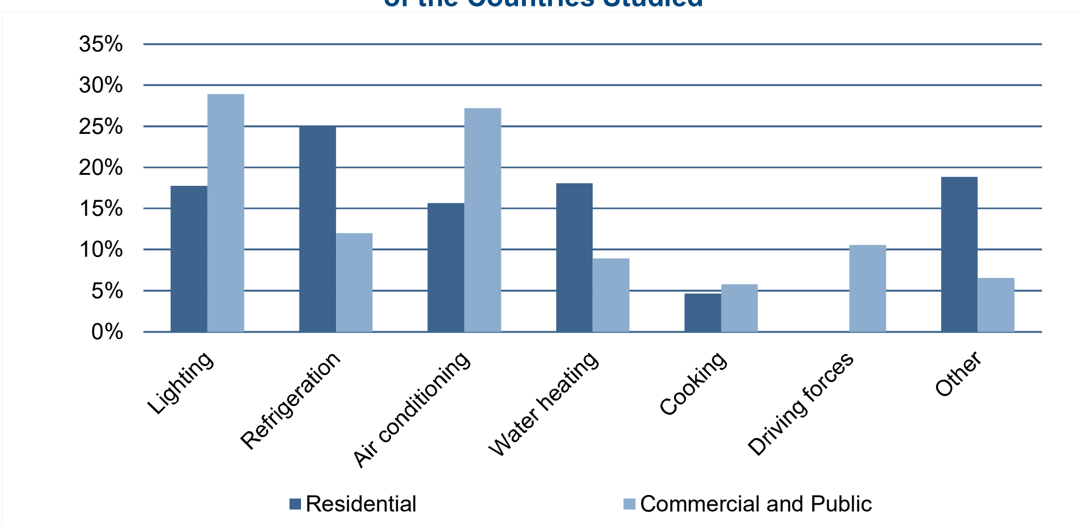

Figure 5 clearly shows that the most significant end-uses of electricity—in every sector—are lighting, refrigeration, air conditioning and water heating.

Comparative Analysis

Based on the comparative analysis of the standards and on the institutional context of each country, key points were compiled in the following tables as to clearly demonstrate that some countries do have the right framework for developing standards, while others lack various processes to successfully support a standards program.

[8] Prepared by the authors of the report based on the most recent energy balances of each country. Details can be found in the report.

Table 1: Favorable Energy Situation for the Development of EE Standards

Countries	Favorable Energy Situation for the Development of EE Standards			Classification of the Energy Situation (1 = most favorable, 7 = least favorable)
	High ratio of electricity production from non-renewable sources	High electricity rates	High energy intensity	
Argentina	✓✓		✓✓	4
Brazil		✓✓	✓✓✓	3
Colombia		✓	✓✓	5
Costa Rica			✓✓	7
Jamaica	✓✓✓	✓✓✓	✓✓✓	1
Mexico	✓✓	✓	✓✓✓	2
Panama	✓	✓✓	✓	4
Peru	✓	✓	✓	6
Dominican Republic	✓✓✓	✓✓	✓	2
Uruguay		✓✓	✓✓	4

As shown in Table 1, Jamaica, followed by Mexico and the Dominican Republic, has the most favorable energy situation for any EE initiative, including EE standards. Mexico's situation could also be considered as favorable given the energy policy decisions made by the government, with the objective of reducing its financial support in the form of subsidies to the residential rate.

Comparative Analysis of the Institutional, Regulatory and Financial Frameworks

Most of the selected countries have entities dedicated to EE, the oldest being Mexico's CONUEE (1989), Colombia's UPME (1994) and Brazil's ANEEL (1996). However, entities in other countries are not agencies independent of the energy departments within the governments, but rather EE directorates or units within larger energy directorates or secretariats.

As for the entities dedicated to standardizing EE, the situation varies widely from one country to another. All countries have entities in charge of standardization at the national level in all sectors. Some countries also have programs (e.g. PRONUREE in Argentina), management committees (e.g. Brazil and Panama) or entities dedicated to developing EE standards (e.g. CONUEE in Mexico). These entities are at times one and the same.

Developing EE standards must be supported by a strong regulatory framework for EE. This regulatory framework is generally supported by legislation, and the ensuing regulations, policies, plans, strategies and programs related to EE. All ten countries studied have a roughly similar regulatory framework and most of them have EE legislation (see Figure 6). Legislation is being drafted in the Dominican Republic. In Argentina, no EE legislation exists per se, but the 2007 PRONUREE program applies by decree and nearly has force of law. As of yet, there is still no draft bill in Jamaica.

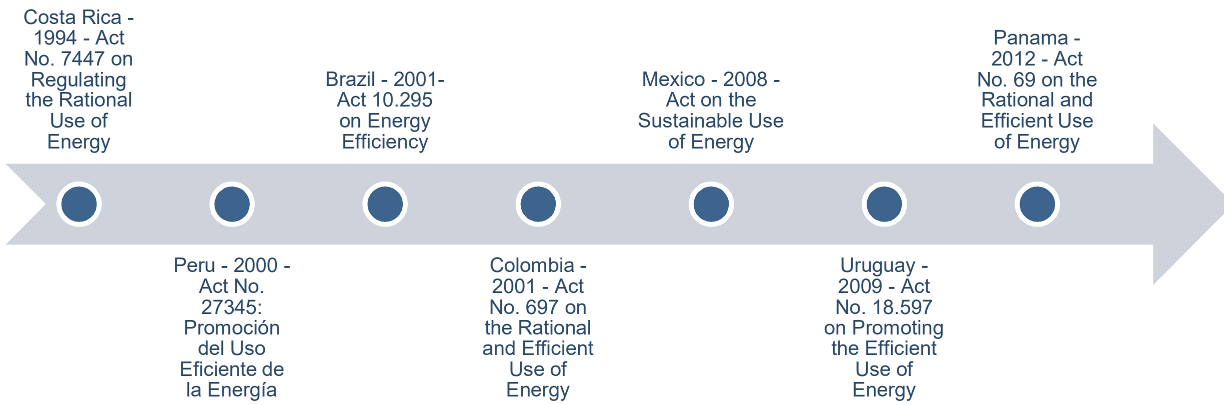

Figure 6: EE Legislation

Likewise, most countries have **plans and programs for EE**, although a difference lies in how long those plans and programs have been around, thus highlighting the cultural differences among countries when it comes to EE. Various programs dedicated to EE do exist in the countries under study, whether national or sector-specific programs. There are nonetheless few programs developed specifically for the implementation of standards and labelling, even though it is well worth drawing lessons from international experience in these fields.

EE standards require significant **financial** and human **resources**. Once established, they generate such significant energy savings that they greatly surpass the investments. For these reasons, setting EE standards requires commitment towards long-term continued financing through annual budgeting. Financial sustainability is a crucial issue since standards and labelling require regular updates. In turn, those updates require the permanent collection and analysis of information on the part of institutions in charge of such work.

There has been a high level of involvement from multilateral organizations in providing funds (loans and/or technical assistance) dedicated to EE projects or programs, and to initiatives aimed at developing EE standards and labelling given their large impact on energy consuming. There are dedicated funds for EE, such as Argentina’s Fondo Argentino de Eficiencia (FAEE) and Uruguay’s Fideicomiso Uruguayo de Ahorro y Eficiencia Energética (FUDAEE) but they alone cannot meet the demand in terms of financing EE initiatives.

There are still barriers hampering EE initiatives and the development of standards, such as the following:

Barriers to EE	Barriers to the Development and Performance of Standards

• Lack of political will.
• Lack of diseggregated and reliable energy data to design EE programs.
• Weak promotion of EE by public institutions: resources are missing to develop EE initiatives and ensure continuity.
• Lack of financial resources, both for development of initiatives and for the implementation, monitoring and evaluation of those initiatives.
• Financial institutions are ill-informed about the peculiarities of energy-saving.
• Strong aversion by banks to take risks associated with loans granted to energy-saving projects.
• Energy prices distorted by subsidies sends the wrong signal to consumers and makes EE projects less attractive.
• Limited capacity of private players to identify and implement EE initiatives.
• Consumers are ill-informed about the benefits of EE..
	• No entity (in some countries) dedicated to standardization and labelling or no programs or projects promoting EE.
	• Lack of awareness and political decision-making to make progress on the issue of EE standardization.
	• Lack of financial resources for the following:
	  • Testing laboratories
	  • Standard updates
	  • Compliance and auditing program
	• Lack of a comprehensive system for assessing the impacts of EE standards.
	• Missing data for the purpose of assessing impacts is one of the main barriers to setting appropriate levels of energy efficiency.

Comparative and Critical Analysis

There must be more than a favorable energy situation to drive the development of standards, in addition to political will and an institutional and regulatory framework conducive to the development of EE initiatives and standards. The following table summarizes the institutional and regulatory frameworks in the countries studied and classifies them according to their levels of adequacy to developing such EE standards.

Table 2: Favorable Environment for the Development of EE Standards

Countries	Favorable Institutional and Regulatory Framework for the Development of EE Standards				Classification of the Institutional and Regulatory Framework
	Entity dedicated to EE and EE Standards	EE legislation	EE national program	National standardization program	(1 = most favorable, 7 = least favorable)
Argentina	✓✓		✓	✓	2
Brazil	✓✓	2001	✓	✓	1
Colombia	✓	2001	✓	✓	2
Costa Rica	✓✓	1994	✓		2
Jamaica			✓		3
Mexico	✓✓	2008	✓	✓	1
Panama	✓	2012	✓		2
Peru	✓✓	2000	✓	✓	2
Dominican Republic			✓		3
Uruguay	✓	2009	✓	✓	2

Comparison of Standards Related to EE in Buildings

Standards with the potential of having a significant energy impact in the residential, commercial and public sectors were selected given the penetration rate of the equipment, its impact on the overall consumption of the building and/or its unitary energy consumption. The selected technologies were the following: envelope, lighting, air conditioning systems, and refrigerators and freezers. A minimum of seven countries have developed standards for these technologies, as shown in the following table:

Table 3: Overview of the Standards Developed in the 10 Countries Studied

Countries	Envelope	Lighting	A/C	Refrigerator /Freezer
Argentina (AG)	✓	✓	✓	✓
Brazil (BR)	✓	✓	✓	✓
Colombia (CO)	✓	✓	✓	✓
Costa Rica (CR)	✓	✓	✓	✓
Jamaica (JA)	Under development		Under development	
Mexico (ME)	✓	✓	✓	✓
Panama (PA)	Under development	Under development	Under development	Under development
Peru (PE)	✓	✓		✓
Dominican Republic (DR)		✓		
Uruguay (UR)	✓	✓	✓	✓

In many of the selected countries, compiling EE standards in the buildings requires a detailed analysis. Others have comprehensive lists of EE standards, such as Mexico. Whether the standard is compulsory or voluntary is not clear either in most cases.

Incidentally, in most countries it is essential to buy EE standards to have access to it them, which makes availability and consequently usage more difficult for market stakeholders.

Comparison Methodology

Considering the wide-ranging definitions of the energy performance levels and the technologies analyzed under this study, it makes it difficult to establish a classification of the standards by energy efficiency levels, nor is it an easy task to compare them according to the year they came into effect since performance requirements are not necessarily increased as standards are updated.

Building Envelope

The standards analyzed in this section regulate, for the most part, the thermal transmittance of the opaque and transparent closures according to which climate zone the building is located in. The following table presents the main parameters affecting the impact of each standard.

Table 4: Comparison of Standards – Building Envelope

Countries	Number of	Labelled	Voluntary/Compulsory	Sector	Methodology

	Standards				R or U Value[9]	Other
Argentina	4	Yes	Voluntary at the national level; compulsory in the Province of Buenos Aires by decree.	Residential (IRAM 11605, IRAM 11507-4) All buildings (IRAM 11604) Buildings likely to be heated (IRAM 11900)	x	x
Brazil	3	EE labelling and quality label (endorsement label)	Thermal and lighting performance in residential buildings: compulsory Voluntary labelling; compulsory in public buildings by 2020, commercial buildings by 2025 and residential buildings by 2030.	Low-income Residential (NRB 15220) Residential (NBR 15575-1) Labelled: Residential buildings (Ministerial order nº 18/2012 - RTQ-R) Commercial and public buildings (Ministerial order nº 372/2010 - RTQ-C)	x	x
Colombia	1	No	Voluntary in low-income housing; compulsory for other types of buildings since July 2016 in municipalities of more than 1.2 million people and by 2017 in the rest of the country.	All buildings, except for industries		x
Costa Rica	1	No	Voluntary	Buildings in general		x
Mexico	3+1 code	Yes	NOM: Compulsory at the federal level, though construction regulations are enforced at the municipal level. NMX and code: voluntary	Residential buildings (NOM 020-ENER-2011 y NMX-C-460-ONNCCE-2009) Non-residential buildings (NOM 008-ENER-2001) New buildings: code	x	x
Peru	2	No	Compulsory (EM 110 – Thermal and lighting comfort with energy efficiency) Voluntary (technical code for sustainable buildings)	All buildings	x	x
Uruguay	3	No	Voluntary	Residential (UNIT-ISO 1150:2010) Single-family homes and small commercial buildings (UNIT-ISO 13153:2012) All buildings (UNIT-ISO 23045:2008)	x	x

Both Panama and Jamaica are developing standards for the envelope, whereas the Dominican Republic has nothing of the sort, although a roadmap is being developed within the framework of the *Climate Technology Transfer Mechanisms and Networks in LAC project*, which will allow energy-efficient and environmentally sustainable technologies to penetrate the building market.

Standards generally include only one parameter, for instance the thermal transmittance of the envelope. Codes integrate EE requirements into the envelope and in the main equipment installed in the buildings, such as air conditioning, heating, lighting and hot water systems.

In many countries, local governments have the power of developing and implementing their own standards for buildings. Central and federal governments also enforce compulsory standards, but without a proper adoption process at the municipal level, standards are considered optional.

[9] R-value: The thermal performance of a material is the capacity of this material to resist the heat flow.
U-value: Thermal transmittance is the measurement of heat flowing per unit of time and unit area and transferred through a building system made up of one or more flat-faced parallel layers of material, when there is a thermal gradient of 1°C (1 K) between the two environments that this gradient separates.

Future Perspectives

Most standards related to the envelope are only applicable to new buildings, thus excluding major refurbishment and renovations on existing buildings. Future updates should include a refurbishment obligation, apart from tightening EE requirements.

The tendency in EE standards for buildings enveloped is to incorporate requirements aimed at reducing energy demand and increasing EE in equipment. A change in the calculation methodologies to include the development of algorithms integrated into software would not only keep energy uses below certain limits, but would also yield an estimate of the yearly consumption of the buildings.

Lighting Systems

Considering the important relation between energy consumption and lighting, in the residential sector as well as in the commercial and public sectors, most of the countries studied have developed various standards and labelling systems since the 2000s in order to bring down energy use. To date, however, there are no lighting standards in Jamaica, while some are being developed in Panama. With the existing standards in the LAC region, nearly all incandescent lamps have been removed from the market, particularly in Argentina, Brazil and Mexico. Whether those standards are being enforced on a compulsory or voluntary basis depends on each country.

Table 5: Summarized Comparison of Lighting Standards[10]

Countries	Voluntary (V)/ Compulsory (C)	MEPS (M) and Labelled (L) Technologies								
		Other systems	Incandescent lamps	Halogen lamps	Ballasts		Fluorescent tube	CFL*	HPSL**	LED
					Fluorescent	HPSL				
Argentina	V				M					
	C		L				L	L		
Brazil	V			M	M		M			M (2)
	C		M and L			M and L		M and L	L	

[10] Details are found in the report.

Countries	Voluntary (V)/ Compulsory	MEPS (M) and Labelled (L) Technologies								
Colombia	C		M and L	M	M and L		M and L	M and L	M	
Costa Rica	V		M and L					M and L		M
	C				M		M			
Jamaica	None									
Mexico	V						M		M	
	C	M	M	M	M		M	M		M
Panama	Under development									
Peru	V				M and L	M		M		
Dominican Republic	V							M and L		
Uruguay	C		M and L		M and L			M and L		

*CFL: Compact fluorescent lamp

**HPSL: High pressure sodium lamp

Future Perspectives

The selected countries keep developing standards for new technologies, such as LED; Brazil, Costa Rica and Mexico already have existing standards for LED lights, while Argentina and Uruguay are developing them. The rest is expected to implement standards for LED technology given that it applies to all sectors and has become cost effective in recent years.

Air Conditioning Systems

Energy consumption from air-conditioning systems varies significantly from country to country, as some countries have a cold season (southern Argentina, Brazil and Uruguay), and in others a large part of the population lives at high altitudes (Colombia, Mexico and Peru), where air conditioning is not necessary. Air conditioning does, however, account for one of the three largest consumers of electricity in the residential, commercial and public sectors—six of the countries studied have set standards for A/C. Such standards are under development in Panama and Jamaica, but none exists in Peru and the Dominica Republic to date. It should be noted that all existing A/C standards are compulsory.

Table 6: Summarized Comparison of the Air Conditioning Standards[11]

Countries	Voluntary (V)/ Compulsory (C)	MEPS (M) and Labelled (L) Technologies					
		Split	Compact	Window	Room	Divided	Heat pumps
Argentina	C	M and L	M and L				
Brazil	C	M and L		M and L			
Colombia	C	L	L	L			

[11] Details are found in this report.

Countries	Voluntary (V)/	MEPS (M) and Labelled (L) Technologies					
Costa Rica	C	M and L		M and L		M and L	
Jamaica	None	Under development					
Mexico	C	M and L			M and L	M and L	
Panama	None	Four under development					
Peru	None						
Dominican Republic	None						
Uruguay	C		M and L			M and L	M and L

Future Perspectives

The introduction of A/C standards in Jamaica and Panama is expected to help reduce their dependence on fossil fuels and lower their GHGs emissions. In the Dominican Republic, EE regulations urgently need to be implemented, since A/C makes up a large share of the energy consumption in the tourism sector, a key sector of its economy.

Refrigerators and Freezers

Refrigerators and freezers represent on average 25% of the energy consumption in the residential sectors of the selected countries. The penetration rate also varies, depending on the climate zone and the level of investment consumers are making, but it is growing each year and getting close to 100%. This is why seven of the analyzed countries have developed standards or labels for refrigerators.

Table 7: Summarized Comparison of the Standards for Refrigerators and Freezers[12]

Countries	Voluntary (V)/ Compulsory (C)	MEPS (M) and Labelled (L) Technologies			
		Refrigerator	Combined Refrigerator-Freezer	Freezer	Commercial Refrigeration
Argentina	C	M and L	M and L		
Brazil	C	M and L	M and L	M and L	
Colombia	C	M and L	M and L	M and L	M and L
Costa Rica	V	M		M	M
Jamaica	None				
Mexico	C	M and L	M and L	M and L	M and L
Panama	Under development				
Peru	V	M and L	M and L	M and L	
Dominican Republic	None				
Uruguay	C	M and L	M and L	M and L	

Whether standards are implemented on a compulsory or voluntary basis varies from one country to another. Standards for refrigerators are being developed in Panama, while none exists in Jamaica and the Dominican Republic.

Future Perspectives

The general tendency in all the countries under study is that their inhabitants will eventually have, as a minimum, a refrigerator in their homes. Updating the existing standards and labels is even more important so that countries can keep benefiting from the energy savings derived from those standards.

Also, commercial refrigerators account for a significant share of the energy consumption and because their volume is greater, higher EE requirements can be required of them.

Other Standards

Countries with standardization programs for EE can then rely on standards for technologies used in selected residential, commercial and public buildings based on the potential energy savings determined through a set of varied methodologies.

[12] Details can be found in the report.

Table 8: Comparison of Other Electrical Standards for EE in Buildings[13]

Countries	Voluntary (V)/ Compulsory (C)	MEPS (M) and Labelled (L) Technologies										
		Fans	Water heaters	Dishwashers	Washers and dryers	Kitchen equipment	Circulating pumps	Small motors	Television sets	Electronic appliances on standby mode	Photovoltaic systems	Solar thermal systems
AG	C				M and L				L			
	V		L			L						
BR	C	L	L		L	L	L	M and L	L		M and L	L
CO	C		M and L		M and L			M and L			M	M
CR	V					L		E				
JA	None											
ME	C				M and L		M and L	M and L		M and L		
	V											M and L
PA	Under development											
PE	V		M and L					M and L			L	M and L
DR	None											
UR	C		M and L		M and L			M and L				

[13] Details are found in this report.

Table 9: Comparison of Other Standards for EE for Gas Appliances in Buildings[14]

Countries	Voluntary (V) / Compulsory (O)	MEPS (M) and Labelled (L) Technologies			
		Instantaneous gas heaters	Storage gas heaters	Domestic cooking appliances	Convection heating equipment
Argentina	C	M	M	M and L	M
	V				
Brazil	C	M and L	M and L	M and L	
Colombia	C	M and L	M and L	M and L	
Costa Rica	V				
Jamaica	None				
Mexico	C	M and L	M and L	M and L	
Panama	Under development				
Peru	V	M and L	M and L		
Dominican Republic	Under development				
Uruguay	C	M and L	M and L	M and L	

Future Perspectives

In the sectors analyzed, the generation of hot water was one of the major end-uses, as shown in

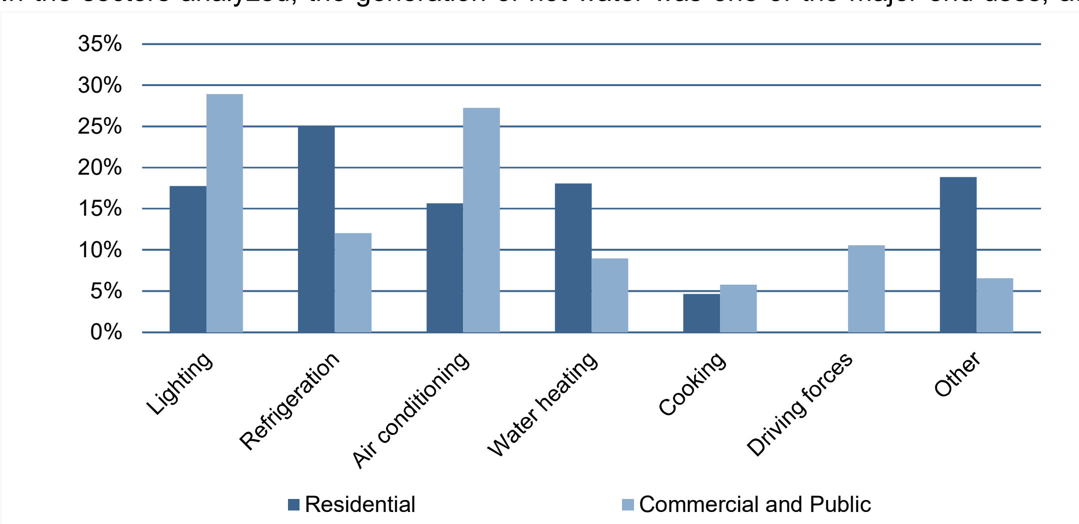

Figure 5. Consequently, standards for electrical and gas-fired water heaters as well as solar thermal systems should be strengthened as to have a positive impact in reducing energy use in buildings and reducing GHG emissions.

[14] Details are found in this report.

Best Practices in EE Standards

Guides to good practices on implementing EE standards and labelling already exist. CLASP[15] is one of the NGOs whose mission is to improve the environmental and energy performance of equipment, appliances and any related systems that we use daily, thus mitigating the impact they have on people and the world we live in. Best practices are based on the S&L Guidebook[16]) by CLASP, which is intended for government officials and other stakeholders around the world who are in charge of developing, implementing and enforcing standardization and labelling programs and of maintaining them over time. Best practices can also be found in IDB's Guía E: Programas de normalización y etiquetado de eficiencia energética[17] [Guide E: Energy Efficiency Standardization and Labelling Programs], which complements the CLASP guide.

Impact of the Standards

The impact of standards—whether actual standards or labels—is represented in the figure on the right. Minimum energy performance standards spread energy-efficient products further into the market, eliminating less efficient models and setting a benchmark for EE programs. Labels provide information to consumers and incite manufacturers to design more energy-efficient products.

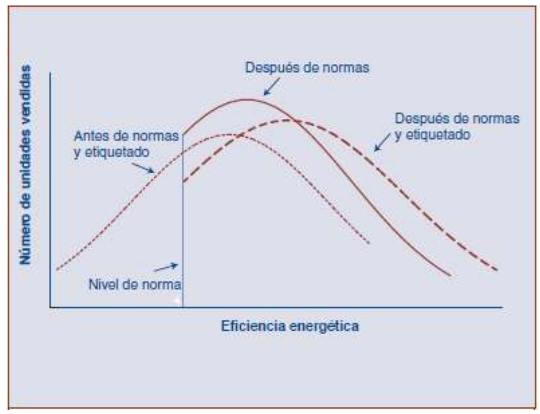

Figure 7: Impact of Standards[18]

[15] http://clasp.ngo/
[16] http://clasp.ngo/Resources/Resources/PublicationLibrary/2003/SL-Guidebook-Spanish
[17] https://publications.iadb.org/handle/11319/7326
[18] Source: CLASP

Best Practices and Key Factors for the Successful Implementation of an EE Standards Program

The typical steps to be taken during the process of developing EE standards and labels defined by CLASP are presented in Figure 8. All these steps are described in detail in the CLASP Guide and briefly in Section 3.1 of this study. It is nonetheless worth mentioning the key success factors[19] for the development of EE standards.

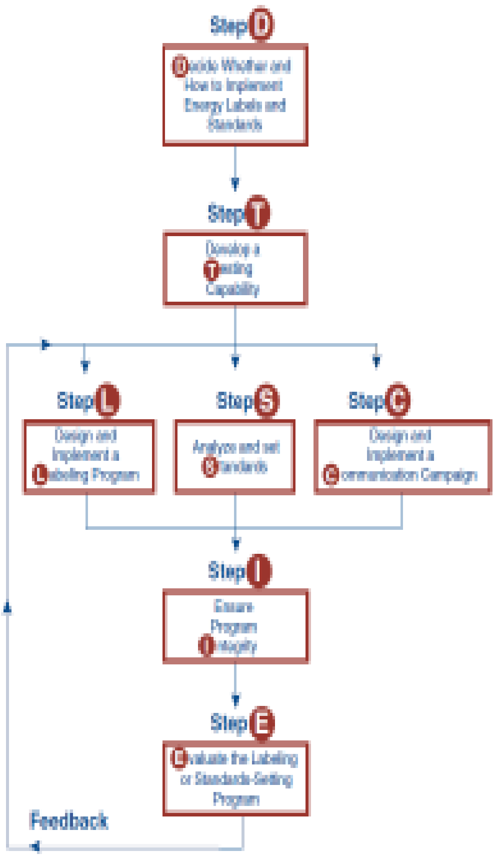

Figure 8: Steps to Developing Standards and Labelling[16]

Key Factors for the Successful Implementation of EE Standards

- Implementing a clear and strong institutional and regulatory framework.
- Using standards and labelling as basis for national energy policies.
- Securing continued funding sources for the program administrator and the program itself.
- Allocating the few resources to products that can derive the greatest benefit for the public.
- Allowing sufficient time and resources to gather data and conduct a market characterization study.
- Developing and implementing transparent and reliable testing procedures.
- Aligning testing procedures on energy performance with international protocols and those of neighbouring countries.
- Getting the manufacturers and all interested institutions involved early on for the standards design and enforcement process.
- Allowing sufficient time and resources to analyze the effects of the potential for energy savings in any potential standard.
- Implementing a program verification and monitoring system.
- Allocating sufficient resources to monitor, evaluate and report on the impact of the program.
- Being prepared to resist strong political pressures!

The decision of implementing compulsory or voluntary standards and labelling is an aspect of the global design program. A key factor for success is the involvement of market players: importers, manufacturers, makers, sellers, institutions and consumers. A successful EE standards program must combine a set of factors for the legal, institutional, financial and social aspects of the program, depending on the situation in each country.

[19] Prepared by the authors of the report based on the CLASP and IDB guides.

Critical Analysis and Conclusion

Based on the comparative analysis and the critical analysis of the standards and on the institutional context of each country, a close connection between the institutional and regulatory framework for EE and the development of EE standards can be observed, as shown the figure below. Countries with at least one entity or program dedicated to designing EE standards have developed many more EE standards than countries that had none.

It should be noted that Panama has a program dedicated to developing EE standards. As of April 2017, 14 compulsory standards were in development through that program.

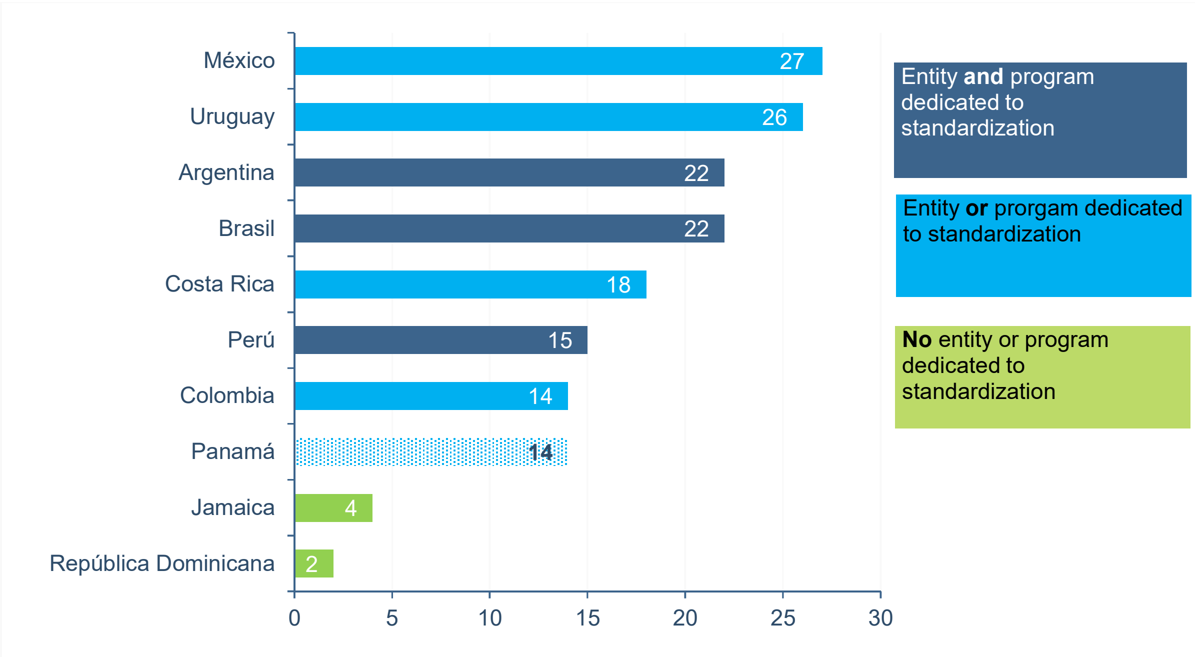

Figure 9: Number of EE Standards per Country[20] vs. Regulatory Framework

Even though Caribbean countries enjoy a favorable energy situation for the developing of EE standards in buildings, Jamaica and the Dominican Republic have the lowest of level development in terms of EE standards due to weak, non-binding institutional and regulatory frameworks, as shown in Table 10 below.

Conversely, countries with a less favorable energy situation, such as Costa Rica or Uruguay—respectively ranked in 3rd and 4th positions—have strong frameworks, which in turn greatly favors the development of EE initiatives and standards. This clearly shows that political and institutional will have more weight when it comes to making the decision of implementing EE standards, as shown in the following table.

Table 10: Existing Processes and Financing for the Success of EE Standards

Countries	Necessary Processes					Sources of Continued Financing
	Testing laboratory in country	Ex-ante cost-benefit analysis	Monitoring and follow-up	Impact evaluation	Standard updates	

[20] In the analyzed sectors.

Argentina	✓	-	✓	-	No defined timeframe	✓
Brazil	✓	-	✓	-	Revision Plan as per the program of goals not followed	✓✓
Colombia	✓	✓	✓	-	Every five years by law	✓
Costa Rica	✓	✓ Only for compulsory standards	✓	-	Every five years by law	✓
Jamaica	-	-	-	-	-	-
Mexico	✓	✓	✓	✓	Depending on the standard	✓✓✓
Panama	-	-	✓	-	-	✓
Peru	-	-	-	-	-	✓
Dominican Republic	-	-	-	-	-	-
Uruguay	✓	✓	✓	-	-	✓✓

The quantitative and qualitative aspects of the processes have a significant impact among the countries analyzed, particularly on standards related to the building envelope.

Brazil, Mexico and Uruguay have the most advanced EE standards and labelling among the countries studied.

Institutional Framework and Political Will

Countries with a strong institutional framework and a designated entity to manage standards and labelling programs have more success. More standards are being set out in those countries, with more rigorous implementation and monitoring processes.

Political will is key to making standards and labelling compulsory, though a decree or regulations are generally necessary to make a standard or label compulsory. Consequently, the executive authority has a major role in implementing such standards.

Standards and Labelling Programs

Developing a standards and labelling program helps select the equipment and envelopes that should be regulated. Countries with a program generally integrate more standards than countries that issue them one by one. What is more, a program can act as a framework within which definition, issuance, follow-up and monitoring processes are established. These processes further normalize the development of standards, which in turn requires fewer efforts.

Updating Levels of Energy Performance

Technologies that are regulated through standards evolve fairly quickly. Each year, the performances of refrigerators, air conditioners, motors and other equipment increase as the prices for such equipment decrease. Regulatory bodies therefore have opportunities to update standards and labelling as to elevate minimum performance levels. Many countries work out regular standard updates into their plans and programs, though the planning of these updates is not always followed. This shortcoming deprives countries of significant energy savings.

Ex-Ante and Ex-Post Impact Evaluation

Ex-ante evaluations define the costs and benefits of the countries and stakeholders, especially those of the manufacturers, laboratories and users. This analysis is not performed in many countries and the methodology used can be obscure. Despite these deviations from best practices, countries that perform cost-benefit analyses before implementing standards are still regarded as being on the path to success.

As for the ex-post energy and economic impact evaluations, the only country where studies are being performed for some standards is Mexico. That phase of a standards and labelling program helps better understand market developments and adjust standards and labels to reality and market transformations. The annual ex-post evaluation gives an indication of when it is time to update the minimum performance levels of technologies.

Recommendations

In light of the reference documents that we recommend should be followed[21], and the outcomes of this comparative study, some specific recommendations may be made to ensure the EE standards achieve the expected results.

[21] Guía E: Programas de normalización y etiquetado de eficiencia energética, IDB, December 2015 https://publications.iadb.org/handle/11319/7326
Normas y Etiquetas de Eficiencia Energética: Una Guía para Electrodomésticos, Equipo e Iluminación, CLASP, September 2013

Institutional Framework

- Setting up leading institutions for the planning, coordination, implementation and monitoring of energy efficiency policies and programs, such as CONUEE in Mexico.
- Creating an entity or program dedicated exclusively to developing standards and labelling to promote the issue. Countries with such entities are those with the most developed standards and labels, such as Mexico and Uruguay.

Data

- Ensuring data and indicators on energy efficiency are gathered regularly.
- Conducting market characterization studies to obtain reliable data.

Testing

- Making sure the testing laboratory has international accreditation as to ensure accuracy, neutrality and credibility.
- Collaborating and harmonizing standards on a regional level as well as testing protocols as to reduce costs and avoid useless differences between technical standards. In Central America, technical regulations (RTCA) are being developed for various appliances which will apply in countries of that region.
- Sharing testing laboratories at the regional level to reduce costs. Since investments for such laboratories can be significant, smaller countries are recommended to come together to set up a common laboratory that would validate standards enforced in various countries.

Involvement of the Interested Parties and Method of Information Dissemination

- Designers and implementors of standards must pay attention to all market players (i.e. manufacturers, importers, distributors, sellers and consumers) as they hold key information that could be of use during the program design and implementation, and later throughout the implementation-monitoring-evaluation-adjustment cycle.
- During the design and implementation of standards and labelling programs, the market is of crucial importance so that consumers understand the advantages of buying energy-efficient products.
- Making sure the information given to the public is reliable and credible.
- Organizing awareness-raising and information campaigns to fight against the lack of knowledge on energy efficiency.

Verification, Monitoring and Evaluation

- Setting up a verification system for the compliance of standards and labelling as well as an auditing system, in case of flaws.

Financing

- Making sure the initial budget for standard design and annual budgets for monitoring, verification, compliance and evaluation are sufficient and ongoing.

Cooperation and Regional Harmonization

- Fostering cooperation between countries, for instance through COPANT, to optimize resources (laboratories, monitoring, etc.) and harmonizing the parameters for the standards.

→ All of the above recommendations are key success factors for EE standards.