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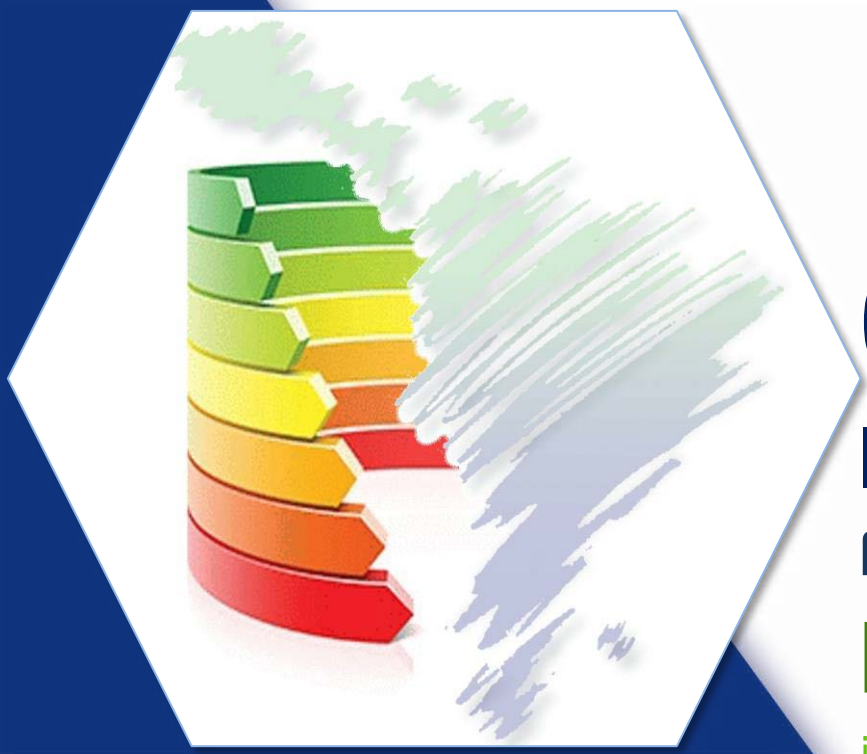

QUALITY INFRASTRUCTURE FOR ENERGY EFFICIENCY PROGRAMS

in Latin America and the Caribbean

Quality Infrastructure for Energy Efficiency in Latin America and the Caribbean

Policy Position Paper

October 2020

Cooperan:

This document is a Policy Position Paper designed to present the main aspects to be considered when it comes to developing a Quality Infrastructure that can provide a solid basis for promoting energy efficiency in Latin America and the Caribbean. The study was put together by Karl-Christian Goethner, Siegburg, a consultant to the PTB (Physikalisch-Technische Bundesanstalt, the German National Metrology Institute), Sibylle Braungardt, Freiburg (Germany) and Andrés Schuschny, Director of Studies, Projects and Information at the Latin American Energy Organization (OLADE). The executive coordination of the project was undertaken by Karl Christian Goethner. During the preparation of the case studies valuable inputs were provided by the National Institute of Metrology, Qualidade e Tecnologia (INMETRO) of Brazil, the Ministry of Industry, Energy and Mining (MIEM) of Uruguay and the Superintendency of Electricity and Fuels (SEC) of Chile. The cover photo was taken by Karl Christian Goethner and depicts a Washing Machine Testing Laboratory in Chile.

The publication is the result of more than eight years of work carried out by two PTB energy efficiency and renewable energy projects, in collaboration with the OAS, SIM, COPANT and IAAC, with the aim of underlining the importance of technical competence on the part of Quality Infrastructure services for successfully implementing energy efficiency labelling programs and improving these services. Financing support was provided by the BMZ, the German Federal Ministry for Economic Cooperation and Development. The participants in the various workshops and two regional inter-comparisons (for refrigerators and residential LEDs) included several hundred experts and politicians from the OAS, SIM, COPANT, IAAC and OLADE, from testing laboratories, inspection agencies, ministries and secretariats of energy, regulatory agencies and customs authorities in Latin American and Caribbean countries, as well as the European Commission, IEC, UNEP, CLASP, DIN and PTB. It is impossible for us to mention all the colleagues who contributed to the progress of recent years; however, we would like to thank the following people, in particular, for their input and commitment: Juraj Krivošik (SEVen, Czech Republic), Ana María Carreño (CLASP), Christoph Tuerk (VDE Institut, Germany), Veerle Beelaerts (Energy Directorate, European Commission), Linda Rincule (Consumer Rights Protection Centre, Letonia), Marcos Borges, Gustavo Kuster and Gregory Kyriazis (INMETRO, Brazil), Ronnie Hernández, Cristián Baeza and Alejandro Onofri (SEC, Chile), Alfonso Herrera (MAE, Costa Rica), Luis Fernando López (Minminas, Colombia), Omar Baez (UPME, Colombia) and Carlos Chica (Haceb, Colombia) , Carolina Mena, Carlos Briozzo and Jorge Peña (MIEM, Uruguay). There is some progress made and some changes since the previous spanish version of this document of May 2019.

The opinions expressed in this document are the sole responsibility of the authors and do not necessarily reflect those of the participating organizations.

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Acronyms

AFNOR	Association Française de Normalisation
ANCE	Asociación Nacional de Normalización y Certificación A.C., México – Mexican Standardization and Certification Association
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
BIEE	Base Indicators for Energy Efficiency
BIPM	Bureau International des Poids et Mesures
CAB	Conformity Assessment Body
CAN	Comunidad Andina - Andean Community
CAP	Conformity Assessment Procedures
CARICOM	Caribbean Community
CASCO	ISO Committee on Conformity Assessment
CENAM	Centro Nacional de Metrología – NMI of Mexico
CIE	Comission Internationale de l'Éclairage – International Commission on Illumination
CIPM	Comité International des Poids et Mesures – International Committee for Weights and Measures
CIPM MRA	CIPM Mutual Recognition Arrangement
CLASP	Collaborative Labeling and Appliance Standards Program
CONPES	Consejo Nacional de Política Económica y Social, Colombia – Colombian National Economic and Social Policy Council
COPANT	Comisión Panamericana de Normas Técnicas – Pan-American Commission for Technical Standards
DakkS	Deutsche Akkreditierungsstelle GmbH – German Accreditation Body
DIN	Deutsches Institut für Normung – German Institute for Standardization
EC	European Comission
ECLAC	United Nations Economic Commission for Latin America and the Caribbean
ECPA	Energy and Climate Partnership of the Americas
FINCA	Forum of the National IEC Committees of the Americas
GDP	Gross Domestic Product
GEF	Global Environment Facility
GTF	Global Tracking Framework
IAAC	Inter American Accreditation Cooporation
IAF	International Accreditation Forum
R+D+i	Research, Development and Innovation
IDB	Inter-American Development Bank
IEA	International Energy Agency
IEC	International Electrotechnical Commission
IEC-LARC	IEC Regional Office for Latin America
ILAC	International Laboratory Accreditation Cooperation
INDC	Intended Nationally Determined Contribution
INDECOPI	Instituto Nacional de la Defensa de la Competencia y de la Protección de la Propiedad Intelectual, Perú – Perivian National Institute for the Defense of Competition and the Protection of Intellectual Property
INMETRO	Instituto Nacional de Metrologia, Qualidade e Tecnologia, Brasil – Brazilian National Institute of Metrology, Quality and Technology
IPEEC	International Partnership for Energy Efficiency Cooperation
ISO	International Standardization Organization
LAC	Latin America and the Caribbean
LED	Light-emitting Diode
MEPS	Minimum Energy Performance Standards
MERCOSUR	Mercado Común del Sur – Southern Cone Common Market

NAB	National Accreditation Body
NIST	National Institute for Standards and Technology – NMI of the United States
NMI	National Metrology Institute
NOM	Norma Oficial Mexicana – Mexican Official Standard
NSB	National Standardization Body
OAS	Organization of American States
OLADE	Organización Latinoamericana de Energía – Latin American Energy Organization
QI	Quality Infrastructure
PALCEE	Programa para América Latina y el Caribe de Eficiencia Energética – Energy Efficiency Program for Latin America and the Caribbean
PBE	Programa Brasileiro de Etiquetagem – Brazilian Labelling Program
PCB	Product certification body
PT	Proficiency Test
PTB	Physikalisch-Technische Bundesanstalt – German NMI
RTCA	Reglamento Técnico Centroamericano – Central American Technical Regulation
SDG	Sustainable Development Goals
SEC	Superintendencia de Electricidad y Combustibles, Chile – Chilean Superintendency of Electricity and Fuels
SE4ALL	Sustainable Energy for All
SERNAC	Servicio Nacional de Consumidores, Chile – Chilean National Consumer Service
SI	International System of Units
SIC	Superintendencia de Industria y Comercio, Colombia – Colombian Superintendency of Industry and Commerce
SICA	Sistema de Integración Centroamericana – Central American Integration System
SIM	Sistema Interamericano de Metrología – Inter-American Metrology System
SME	Small and Medium Enterprise
S & L	Standards and Labelling
TC	Technical Committee
TR	Technical Regulations
U4E	United for Efficiency
UKAS	United Kingdom Accreditation Service
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
USD	US Dollar
WHO	World Health Organization
WTO	World Trade Organization

Foreword

The term Quality Infrastructure includes the entire network of public and private institutions, as well as the legal and regulatory frameworks and the various practices and actions defined and implemented as part of standardization, metrology, accreditation and conformity assessment of the products and services offered to the market. Ensuring an adequate Quality Infrastructure is one of the most effective means to improve the productivity of countries, create robust markets, boost competitiveness and enhance trade with the rest of the world, while promoting safety and protection of the environment.

Developing a Quality Infrastructure ecosystem that meets a country's needs can prove to be a highly complex task. It is not just a matter of implementing standards but also includes essential aspects such as the development of traceable and comparable measurement capabilities, the calibration of measurement instruments, the implementation of conformity assessment services (testing laboratories, inspections, certifiers) and their accreditation – activities in which various institutions are involved, such as standardization institutes, national metrology institutes, national accreditation bodies, testing and calibration laboratories, product certification bodies, consumer associations, manufacturers, importers and trading companies, customs and other public sector organizations, academia and civil society.

Both OLADE and the German National Metrology Institute (PTB) fully recognize the relevance of Quality Infrastructure as a driving force and an effective promoter of energy efficiency in Latin America and the Caribbean (LAC), which is why we decided to come together to produce this Policy Position Paper on Quality Infrastructure for Energy Efficiency Programs in LAC. This document details the efforts made by the German National Metrology Institute (PTB) over the last eight years, with support and funding from the Federal Ministry of Economic Cooperation and Development (BMZ) of Germany, during which it has cooperated closely in our region with the Organization of American States (OAS) and regional metrology organizations, the Inter-American Metrology System (SIM), the Pan American Commission on Technical Standards (COPANT) and the Inter American Accreditation Cooperation (IAAC).

Ensuring the existence of an infrastructure that can reliably measure the energy consumed by different devices and equipment is an important way to shore up the efforts made by countries towards the necessary goal of improving energy efficiency in end uses of energy and mitigating the adverse effects caused by greenhouse gas emissions. Standards and labelling programs have been recognized as two of the most effective and efficient policy measures designed to address the energy efficiency of products. Most countries in Latin America and the Caribbean have introduced such programs. However, much remains to be done and the Quality Infrastructure becomes a key component when it comes to improving the effectiveness of these programs. Indeed, issues related to conformity assessment procedures and their harmonization and comparability for labelled products have become increasingly important topics given the changes being introduced to achieve a cleaner energy matrix and promote a more rational use of energy.

This study begins by outlining the importance of energy policy in the context of climate change. It goes on to list the key elements of conformity assessment and explain their relevance to energy efficiency programs. Finally, it provides a summary the cooperation experiences undertaken by the various actors in our region and describes a few practical examples of implementation in Latin American and Caribbean countries.

We hope that this document will become an essential reference that can help promote the consolidation of the Quality Infrastructure among actors in the energy sector and encourage further coordination and integration on the subject between the countries of our region.

Alfonso Blanco
Executive Secretary
Latin American Energy Organization
OLADE

Marion Stoldt
Director, Technical Cooperation
German National Metrology Institute
PTB

Introduction

This document reflects the results of eight years of technical cooperation between the PTB – the German National Metrology Institute – and its counterparts, the Organization of American States (OAS) – as a political partner – and the regional organizations governing metrology – the Inter-American Metrology System (SIM); standardization – the Pan-American Commission for Technical Standards (COPANT); and accreditation – the Inter-American Accreditation Cooperation (IAAC). The aim of this cooperation has been to improve quality services in order to promote the energy-efficient use of household appliances. From the outset, the cooperation activities have focused on the implementation of labelling programs and the exchange of experiences, both between Latin American and Caribbean countries and with other regions such as Europe, Asia and North America. In 2012, a Kick-off Workshop was held in Fortaleza (Brazil), followed by three Latin American and Caribbean forums: in Itaipava (Brazil) in 2013, Quito (Ecuador) in 2015, Bogotá (Colombia) in 2017, along with a workshop on border control and market surveillance in Montevideo in 2018. Other organizations involved in the field have also cooperated, such as the Latin American Energy Organization (OLADE), the Economic Commission for Latin America and the Caribbean (ECLAC), the European Commission, DIN, IEC-LACR, SEVen (Czech Republic), VDE Institut (Germany), CLASP, PNUMA, UNDP and UNEP. In addition, other important activities have been carried out, including the implementation of a proficiency test for refrigerators and another for residential LEDs, supported by the VDE Institut.

Issues related to conformity assessment procedures and their harmonization and comparability for labelled products have become increasingly important topics, given the changes being introduced in order to develop a cleaner energy matrix and promote more rational energy use. Their importance was not fully appreciated at first by the main government entities associated with these matters in the countries of the region. It has thus proven extremely useful to aim towards improving the technical competencies of the Quality Infrastructure (QI) services, with particular emphasis on conformity assessment bodies (CAB). It was possible to establish productive contacts with actors in many countries whose interest and involvement and the experiences they shared contributed to the progress of these activities. It is impossible for us to mention all the colleagues who contributed to the progress made in recent years; however, we would like to thank the following people in particular for their input and commitment: Juraj Krivošik (SEVen, Czech Republic), Christoph Tuerk (VDE Institut, Germany), Marcos Borges, Gustavo Kuster and Gregory Kyriazis (INMETRO, Brazil), Ronnie Hernández, Cristián Baeza and Alejandro Onofri (SEC, Chile), Alfonso Herrera (Costa Rica), Luis Fernando López, Omar Baez and Carlos Chica (all from Colombia), Carolina Mena and her team (MIEM, Uruguay).

This study begins by outlining the importance of energy policy in the context of climate change. It then describes the key elements of conformity assessment and explains their relevance to energy efficiency programs. Finally, it concludes by providing a summary of the cooperation experiences of the project agents and presents case studies from a number of countries.

Executive Summary

1. Introduction

Combatting global climate change by reducing greenhouse gas levels is one of the main challenges that humanity must face in the coming decades. There are various strategies for mitigating these emissions, such as increasing renewable energy penetration, improving natural carbon deposits or reducing consumption by promoting energy efficiency. The latter involves using less energy to produce the same or more goods and services. Given that energy production and use account for two thirds of global greenhouse gas emissions (IEA, 2015a), it will be essential to increase energy efficiency levels in order to reduce these emissions while sustaining the growth of the world economy.

Standards and labelling (S & L) programs have been recognized as two of the most effective and efficient policy measures designed to address the energy efficiency of products. Most Latin American and Caribbean (LAC) countries have introduced such programs. Labelling programs are the cornerstone of most national energy efficiency and climate change mitigation programs and operate in over 80 countries worldwide, covering more than 50 different types of appliances and devices in the commercial, industrial and residential sectors (IEA-4E, 2016). Based on evidence from a broad sample of countries with labelling programs in place, the energy efficiency of the main household appliances has increased the underlying rate of technology improvement more than threefold and has shown a return of 300 percent on national investments in household appliance standards and labelling programs (IEA-4E, 2016).

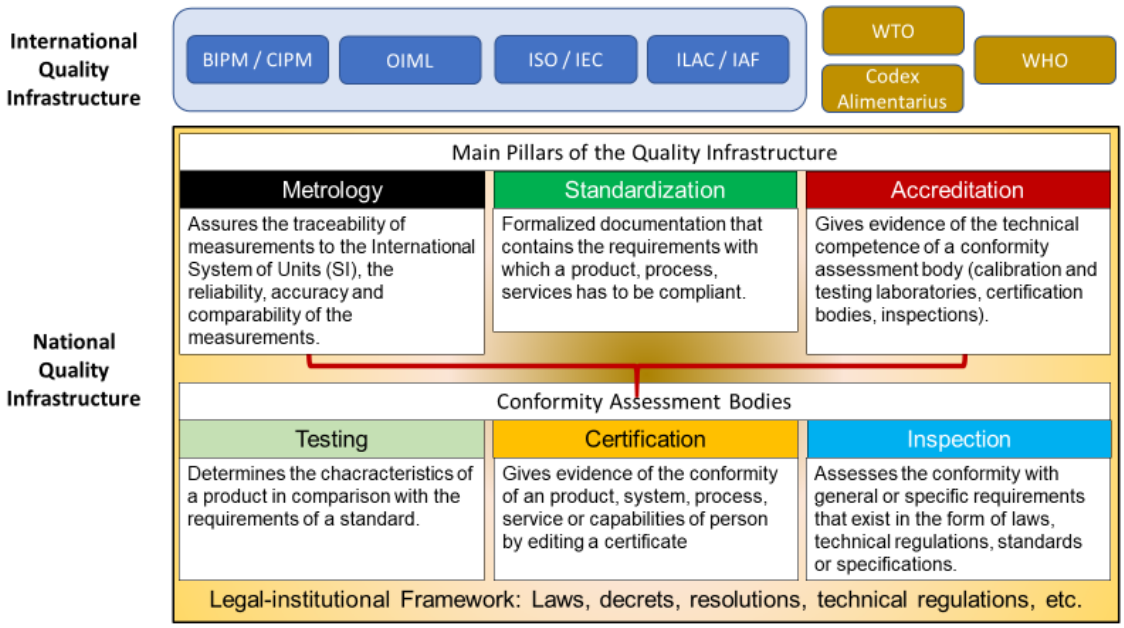
Although there has been more action and interest in setting up labelling programs for devices and household appliances in LAC, the region is facing the problem of a lack of adequate control and testing laboratories (UNEP, 2015). The existence of a common testing procedure provides the technical foundation for all energy efficiency standards, energy labels, and other related programs (Meier and Hill, 1997). To ensure that all products are evaluated in the same way, it is necessary to have measurement standards, standard testing facilities, standard tests, and a procedure to ensure compliance with the tests and their requirements (Wiel and McMahon, 2003).

2. The Quality Infrastructure

The conformity assessment carried out by testing laboratories and certification and inspection bodies is part of what is called the "Quality Infrastructure (QI)."

Figure 1

The National Quality Infrastructure



Source: Prepared by Karl-Christian Goethner

The QI is a fairly complex international, regional and national system that, in addition to conformity assessment bodies (CAB), comprises three main pillars: metrology, standardization and accreditation (see Figure 1):

- Metrology ensures the accuracy and comparability of measurements.
- Standardization standardizes measurements, processes and products, thereby ensuring their comparability and repeatability.
- Based on the established standards, accreditation provides evidence of the technical competence of conformity assessment bodies (CAB).

QI institutions must meet important criteria (See Box 1):

Box 1: QI criteria

- Reliability
- Impartiality
- Transparency
- Traceability
- Comparability
- Repeatability

3. Quality Infrastructure for Labelling Programs

Minimum Energy Performance Standards (MEPS) and labelling programs are underpinned by less visible technical procedures that determine their success (Figure 2).

Figure 2

Factors determining the success of labelling programmes and MEPS

Source: Prepared by Sibylle Braungardt using CLASP materials

Labelling programs are developed and implemented by regulatory agencies that are usually part of or governed by Ministries of Energy. Due to their mandatory nature, labelling programs correspond to technical regulations. The regulatory agencies themselves or special organizations monitor compliance with labelling programs. The supervisory agencies and bodies are technical entities that follow political guidelines. Technical regulations are generally based on international technical standards, which are often adjusted to fit national technical standards. These standards define the characteristics of products and above all the corresponding conformity assessment procedures.

4. Conclusions and Recommendations

4.1 Effective implementation of labelling programs requires the commitment of governments; not only to develop the general legislatory framework but also to develop and strengthen the conditions needed to successfully implement and enforce this type of policy. One element that is lacking in many countries is a Quality Infrastructure (QI) suited to the needs of each economy. This differs from country to country: While countries with developed markets and domestic production of household appliances need a fairly complex QI (NMI, NSB, NAB, testing laboratories and accredited certification bodies), small countries with limited markets and without domestic production require technical experts who know how the system functions and are able to develop and to monitor labelling programs. When in doubt, these countries should be in a position to send products to competent laboratories abroad to carry out the relevant tests.

4.2 Conformity assessment procedures (CAP) for products are the key element when it comes to developing and implementing labelling programs. Each country currently defines its own MEPS and procedures. There is very little harmonization of the procedures and documentation involved, including certificates. The parallel application of two different types of standards – ISO/IEC standards and North American ASTM standards (often in the form of NOM) – further complicates the situation. Several efforts have been launched to harmonize procedures, one of which is the Central American Technical Regulation (RTCA) covering three electrical products at present. COPANT has set up the CASCO Focus Group to address this issue. Unfortunately, only a few countries apply the CASCO models (ISO/IEC 17067). Through its laboratory certification scheme, the IECEE is trying to implement a unified interpretation of the respective testing standards to ensure the comparability of results (www.iecee.org/certification/overview/). OLADE should encourage the harmonization process by explaining its advantages in terms of time and money saved and the ability to compare product performance.

4.3 Within the area of conformity assessment, there is a significant lack of competent and experienced testing laboratories accredited by ISO/IEC 17025. Their existence is a necessary condition for obtaining reliable and comparable test results. One very important instrument for ensuring and improving measurement and testing methods are proficiency tests (PT), which are also required for an accreditation according to ISO/IEC 17025. There is a shortage in the region of experienced providers accredited by ISO/IEC 17043 and with the necessary technical skills and experience to organize PTs. Financing is another challenge. Since it does not make economic sense for each country to have accredited laboratories for the entire range of products, developing regional reference laboratories could be an effective and efficient solution. Promoting these lines of action and encouraging greater levels of regional coordination could also fall within the remit of OLADE.

4.4 Labelling programs cannot be successfully implemented without sufficiently trained and competent personnel. This applies not just to the staff of the NMI, NSB, NAB, laboratories and certifiers, but also to officials from regulatory agencies, customs authorities, control bodies and market surveillance agencies, importers, marketing companies and vendors. Such training is largely a task for the national authorities, but there is also a regional and international dimension to consider, which involves taking into account the regional and international experiences that should be included in national Labelling Programs. OLADE could offer its platform for this kind of work in the regional context.

4.5 Another important issue is the exchange of information and experiences with labelling programs at the regional and international level. It may be useful to implement a Regional Forum on Labelling Programs, as a platform where representatives of the various stakeholders in the region can come together, perhaps bi-annually, to find out about the progress made and address specific issues of common interest that can help improve

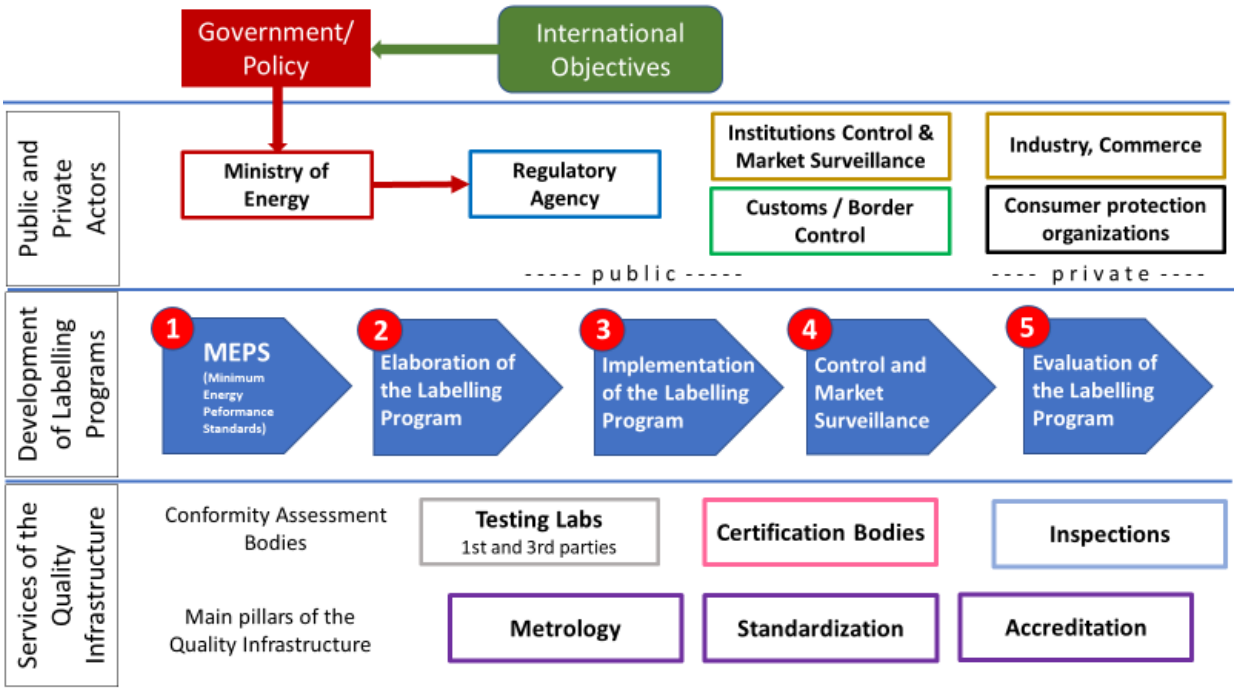
labelling programs and their economic, social and environmental impacts. Forums of this kind can help to bridge the communication gaps that still exist between regulators, QI institutions and other stakeholders, particularly from industry, and consumers.[1]

4.6 It is also important for governments to be aware that it is not possible to have an adequate QI that meets the technical requirements of labelling programs without investment, which should be included in the energy efficiency and labelling programs.

4.7 Another element that would be conducive to implementing labelling programs are regional, sub-regional or binational agreements that facilitate the shipment of electrical products to be tested in accredited laboratories abroad when there are none in the country.

Figure 3

Actors involved in developing and implementing Labelling Programs



Source: Prepared by Karl-Christian Goethner

[1] There have been some very positive experiences involving the organization and implementation of such forums as part of joint projects run by the PTB, OAS, SIM, COPANT and IAAC.

Part I. Energy Policy, Quality Infrastructure and Labelling Programs

1. Energy Policy in the context of Climate Change

1.1 Introduction

Combatting global climate change by reducing greenhouse gas levels will be one of the main challenges for humanity in the coming decades. There are various strategies for mitigating these emissions, such as renewable energy penetration, improving natural carbon deposits or reducing consumption through energy efficiency. The latter involves using less energy to produce the same or more goods and services. Given that energy production and use account for two thirds of global greenhouse gas emissions (IEA, 2015a), it will be essential to ensure energy efficiency in order to reduce these emissions, while sustaining the growth of the world economy.

Improving energy efficiency worldwide is also essential if we are to meet the objectives of the Paris Agreement. Of the 189 countries that submitted Intended Nationally Determined Contributions (INDCs) to the United Nations Environment Program (UNEP), 168 included energy efficiency as one of their priorities. In particular, in developing countries, where energy consumption is growing faster than in developed countries, energy efficiency can offer greater opportunity for economic growth while providing increased access to energy (IEA, 2012).

The Paris Agreement's central objective of keeping the global temperature increase to well below 2 degrees Celsius above pre-industrial levels and to coordinate efforts to limit the temperature increase beyond 1.5 degrees Celsius requires greater emission reductions than countries have pledged (UNEP, 2016). Increased energy efficiency, particularly in developing countries and emerging economies, can play an important role in closing the gap between the reduction in emissions resulting from full implementation of INDCs and the 2-degree/1.5 degree target.

1.2 Investments in energy efficiency

In addition to being regarded as one of the most effective methods of achieving multiple economic, social and environmental benefits, energy efficiency is key to making progress on the Sustainable Development Goals (SDGs) set by the United Nations. Nevertheless, it is estimated that two thirds of the world's potential for energy efficiency still remains untapped (IEA 2016a): over 4 Btoe[2] in the industry and transport sectors, about 2 Btoe in the energy sector and over 5 Btoe in the construction sector (IPEEC 2017 estimated for the period 2011-2035). Although significant increases have been observed in the global rate of energy intensity in recent years[3] (IEA 2016a) in relation to the previous decade (0.6% improvement), these figures are very low when compared to the Sustainable Energy for All (SE4ALL) target of 2.6 percent, which is considered necessary to put "... the world on the path to a decarbonized energy system" (IEA 2016a). This requires investments in efficiency that would be paid back both directly in economic terms as well as providing multiple social benefits – better quality of life, job creation, health improvement, climate change mitigation, etc.

Investments in energy efficiency increased 6% worldwide in 2015, exceeding USD 220 billion, which represents 12 percent of total energy investments (IEA 2016b). The sectors with the highest investment are buildings (including household appliances), transportation and industry. Despite these increases, global investment is insufficient to meet the objectives set out in the Paris Treaty agreements (including SDG 7.3). Limiting the increase in global temperature to 2° C/1.5° C would require an increase in global spending on energy efficiency of up to US$550 billion a year until the 2030s (TC 2016). Efforts in energy policies would need to be increased, especially in the

[2] Billion Tonnes of Oil Equivalent

[3] Global Energy Intensity Rate = Energy Consumption / GDP

public sector, which plays a crucial role as a catalyst in involving the private investment sector: "Public programs are essential to overcome both technical and financial obstacles, encourage economic opportunities for energy efficiency markets, and draw forth much larger amounts of private funding needed to achieve an increase of up to $550 billion per year"(TC 2016). It is also important to note that in most cases, best practices and case studies cannot simply be applied from one country or region to another to attract investments into the energy efficiency sector, but must instead be tailored to local contexts (CEPE 2015).

1.3 Measuring energy efficiency

The publication Regulatory Indicators for Sustainable Energy – RISE (World Bank 2017b) assesses policy and regulatory support in 111 countries for each of the three pillars of sustainable energy: access to modern energy, energy efficiency and renewable energy. RISE is a set of indicators that serve to compare national policy and regulatory frameworks. There are 27 indicators in total, 12 of which are used to assess energy efficiency. In conjunction with the Global Tracking Framework (GTF) (World Bank 2017a), which assesses real progress on sustainable energy, it provides information about the conditions that enable countries to make significant progress towards improving energy efficiency. The GTF report takes a regional perspective, with chapters on five major world regions (including Europe, North America and Central Asia).

1.4 Energy efficiency in Latin America and the Caribbean (LAC)

In Latin America and the Caribbean (LAC), the main source of emissions is the energy production sector, which accounts for 42% of the region's total emissions, followed by agriculture (28%) and changes in land use and forestry activities (21%). Given the region's economic growth and development needs, energy -related emissions continue to rise (OLADE – ECLAC – IDB, 2017), and electricity demand increased by approximately 5.4% per year between 1971 and 2013 and is expected to keep growing (IDB, 2015).

Despite the increasing interest that governments in the LAC region have shown in promoting energy efficiency in recent years, there is still a great deal of untapped potential (OLADE – ECLAC – IDB, 2017). Total energy consumption could be reduced by an estimated 15% to 20% (with no loss in comfort) by applying good practices with rapid payback (ECLAC, 2014; UNEP, 2015). For example, UNEP (2014) states that the introduction of standards, and a transition to better technologies available for refrigerators, air conditioners and electric fans in the residential sector of the LAC region, could generate an annual energy saving of 138 TWh. Strategically implemented energy efficiency measures offer the chance to advance social objectives by transforming the productivity and resilience of energy systems in the countries of the region (ECLAC, 2014).

Several LAC countries are participating in a series of regional and sub-regional initiatives and networks designed to promote energy efficiency. The Latin American Energy Organization OLADE[4] has been implementing the Energy Efficiency Program for Latin America and the Caribbean (PALCEE) for several years, with financial support from the Austrian Development Cooperation Agency. The aim of this program is to promote EE development by strengthening the institutions responsible for guiding and directing EE programs in each of the participating countries. This includes legal and regulatory aspects, in order to achieve sustainable energy savings that can reduce the need for investment in the energy sector, improve the country's finances and succeed in cutting CO_2 emissions. The first phase of the program was implemented in El Salvador, Granada, Jamaica, and Nicaragua, while the second phase is currently under way in Belize and Guyana.

4 http://www.olade.org/

Moreover, OLADE has been managing the Latin American and Caribbean Energy Efficiency Network (Red LAC-EE[5]) since 2011, with the aim of contributing to energy efficiency development in the region through the exchange and dissemination of technical, legal and regulatory information among interested institutions and professionals (UNEP, 2015).

In addition, with the support of the German Cooperation Agency (GIZ), in 2011, the Economic Commission for Latin America and the Caribbean (ECLAC) launched a project on Base Indicators of Energy Efficiency (BIEE[6]) to improve the quality of statistics and performance indicators in order to be able to quantify the results of national energy efficiency programs (ECLAC, 2016).

Another regional initiative that includes the topic of energy efficiency is the Energy and Climate Alliance of the Americas (ECPA) coordinated by the Organization of American States (OAS). The en.lighten initiative run by the United Nations Global Environment Facility (GEF) was set up in 2009 to accelerate the transformation of the global market towards sustainable and efficient lighting technologies, as well as to develop strategies to phase out incandescent lamps and reduce CO_2 emissions and mercury release from fossil fuel combustion. Building on the success of the en.lighten initiative, the United for Efficiency (U4E) initiative was then created. U4E is a global effort supporting developing countries and emerging economies to shift their markets towards energy-efficient appliances and equipment. The Super-Efficient Equipment and Appliance Deployment (SEAD) Initiative of the Clean Energy Ministerial and the International Partnership on Energy Efficiency Cooperation (IPEEC)[7] is a voluntary multinational collaboration whose main objective is to promote the transformation of the global market for energy-efficient products. The Sustainable Energy for All Initiative (SE4All)[8] launched by the Secretary General of the United Nations and the President of the World Bank has three objectives, one of which is to double the global rate of energy efficiency improvements by 2030. Since its creation in October 2013, the Copenhagen Centre on Energy Efficiency (C2E2), which functions as the SE4ALL Energy Efficiency Hub, has been analysing and promoting opportunities to accelerate the global adoption of energy efficiency. The United Nations Development Program (UNDP) has supported the development of labelling programs and the first stages in their implementation (for example in Colombia and Peru).

Standards and labelling (S & L) programs have been recognized as two of the most effective and efficient policy measures for addressing the energy efficiency of products. Most Latin American countries have introduced such programs. Labelling programs are the cornerstone of most national energy efficiency and climate change mitigation programs and operate in over 80 countries worldwide, covering more than 50 different types of appliances and devices in the commercial, industrial and residential sectors (IEA-4E, 2016). Based on evidence from a broad sample of countries with labelling programs in place, the energy efficiency of the main household appliances has increased the underlying rate of technology improvement more than threefold and has shown a return of 300 percent on national investments in household appliance standards and labelling programs (IEA-4E, 2016).

In addition to mitigating climate change, labelling programs can help meet various development goals in the region, including reducing capital investment in energy supply infrastructure, improving national economic efficiency by reducing energy bills, improving consumer well-being, strengthening competitive markets or reducing urban and regional pollution (UNEP, 2015). Other secondary benefits include positive effects on employment, health and energy security.

5 http://red-lac-ee.org/
6 https://www.cepal.org/drni/biee
7 https://ipeec.org/
8 https://www.seforall.org/

Although there has been more action and interest in setting up labelling programs for equipment and household appliances in LAC, the region is facing the problem of a lack of adequate control and testing laboratories (UNEP, 2015). The existence of a common testing procedure would provide the technical foundation for all energy efficiency standards, energy labels, and other related programs (Meier and Hill, 1997). To ensure that all products are evaluated in the same way, it is necessary to have standard metrics, standard testing facilities, standard tests, and a procedure to ensure compliance with the tests and their requirements (Wiel and McMahon, 2003). Differences in test procedures and formats in each country can have impacts on energy use, the environment, and the international economy (Meier and Hill, 1997). In addition, it is necessary to implement the accreditation procedure in accordance with international standards, to ensure that testing facilities carry out tests correctly using properly calibrated equipment. In this regard, one important aspect in the least developed countries is the creation of specific education and training, including periodic tests that use comparisons between laboratories (Wiel and McMahon, 2005). The quality infrastructure (QI), that is, the infrastructure for standardization, measurement, accreditation and conformity assessment (Sanetra and Marbán, 2008), can be created within the country, can be shared between several countries or can be purchased from third countries.

2. The Quality Infrastructure, its Importance for Technical Regulation and its Benefits for the Economy and Society

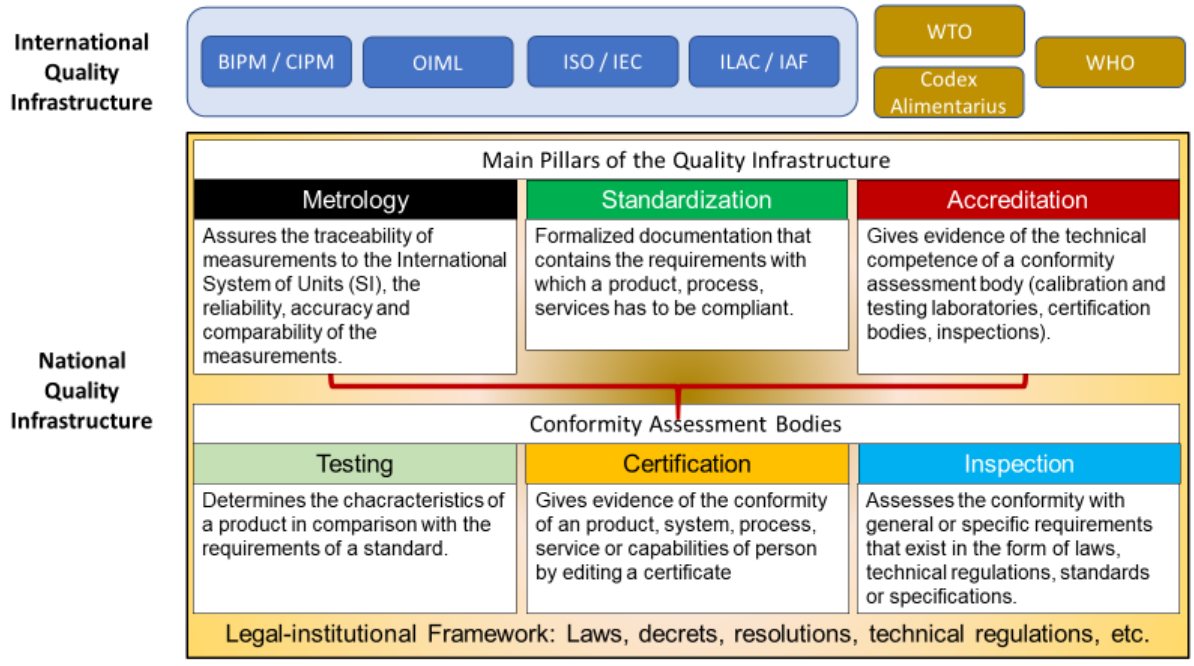
The previous chapter looked at the importance of standardization and labelling programs for improving the energy efficiency of household appliances and thus helping to mitigate climate change. Labelling programs are technical regulations that define the minimum energy performance requirements for household appliances, usually based on Minimum Energy Performance Standards (MEPS). The crucial questions for ensuring the successful execution of such programs are:

> What technical foundations should these programs be based on?
>
> Is it just international standards mediated by National Standardization Bodies (NSB) or are greater technical competences needed?

The experiences of LAC countries show that the success of these programs depends on the conformity assessment procedures (CAP), particularly those that are carried out in accordance with international standards and good practices. The conformity assessment carried out by testing laboratories, certification and inspection bodies is part of what is called the "Quality Infrastructure (QI)."

Figure 1

The National Quality Infrastructure



Source: Prepared by Karl-Christian Goethner

The QI is a fairly complex international, national and regional system that, in addition to conformity assessment bodies (CAB), comprises three main pillars: metrology, standardization and accreditation (see Figure 1):

- Metrology ensures the accuracy and comparability of measurements.
- Standardization standardizes measurements, processes and products, thereby ensuring their comparability and repeatability.
- On the basis of standards, accreditation provides evidence of the technical competence of conformity assessment bodies (CAB).

The QI thus ensures that processes and products have the desired quality and do not negatively affect the health of people and animals or the environment. They are important elements for providing users with guaranteed and reliable information on the comparability of the characteristics of processes and products.

The QI is developed within a mandatory legal and institutional framework imposed by the state. This legal and institutional framework that defines the structure and rules of the system differs from country to country. In Chile, for example, the Metrology Law of 1848, one of the first in Latin America, remains in force. The rest is determined by decrees and resolutions. In Colombia there are laws and decrees,[9] but there are also strategic guidelines provided in the documents produced by the National Council for Economic and Social Policy (CONPES).

Owing to their nature, QI institutions are technical, not political. They must prove their technical competence by means of accreditation (in the case of conformity assessment bodies), peer assessment (in the case of NMIs and NABs) or self-declaration (in the case of NMIs).

QI institutions must meet important criteria (See Box 1):

Box 1: QI criteria

- Reliability
- Impartiality
- Transparency
- Traceability
- Comparability
- Repeatability

There is a system of interrelated international and regional organizations to guarantee compliance with these criteria (see Table 1). Regional organizations are responsible for coordinating work in their regions in accordance with the guidelines provided by international organizations and bringing regional experiences and challenges to light at the international level.

9 Decree 1595 of 5 August, 2015 regulates the National Quality Subsystem – SICAL.

Table 1

National and Regional Quality Infrastructure Organizations

	International Organization	*Regional Organization in the Americas*	*Function*
Metrology	BIPM/CIPM	SIM (Inter-American Metrology System)	Responsible for the accuracy and comparability of measurements to develop and disseminate the International System of Units (SI) CIPM-MRA signatories mutually recognize their measurement results
	OIML (International Organization for Legal Metrology)		Develops model regulations, standards and related documents for use by legal metrology and industry authorities
Standardization	ISO (International Standardization Organization)	COPANT (Pan-American Commission for Technical Standards)	Develops standards for products, processes and the functioning of the international and national QI.
	IEC	IEC-LACR	Defines the safety standards for electronic products and processes and has its own certification scheme for safety and energy efficiency testing laboratories.
		FINCA	Coordinates the work of the IEC National Committees in Latin America and the Caribbean
Accreditation	ILAC (International Laboratory Accreditation Cooperation)	IAAC (Inter American Accreditation Corporation)	Organizes the mutual recognition network among national accreditation bodies in the case of calibration and testing laboratories
	IAF (International Accreditation Forum)		Organizes the mutual recognition network among national accreditation bodies in the case of certification and inspection bodies.

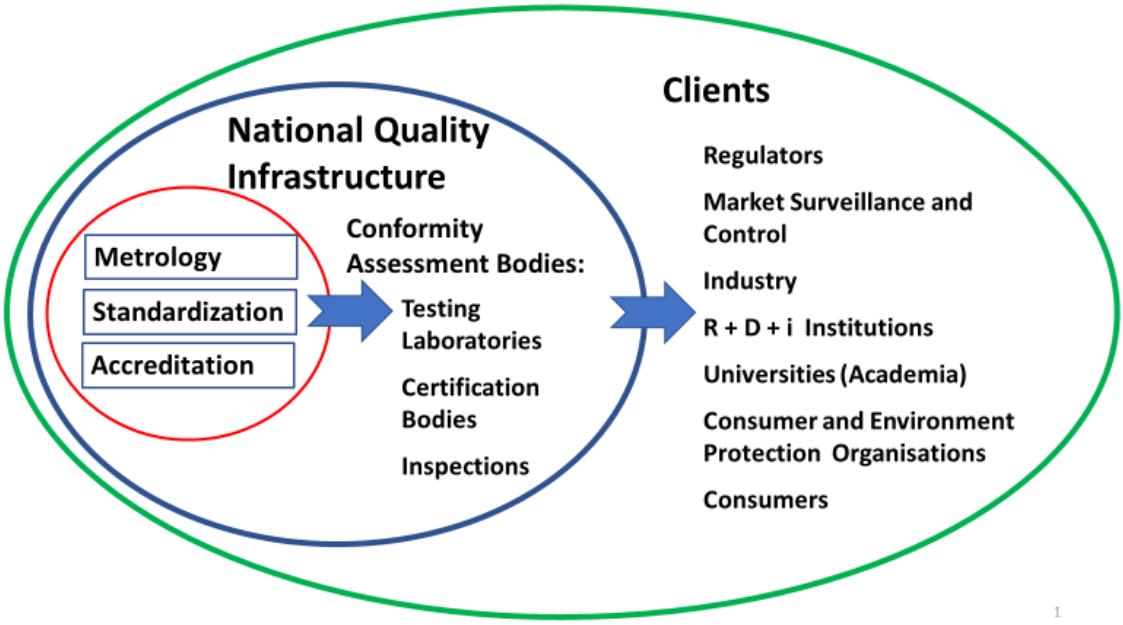
Source: Prepared by Karl-Christian Goethner

The clients of QI services are many and varied: industry; academia; research, development and innovation (R&D&i) institutions; commerce; regulatory agencies; state market surveillance and control bodies; consumers and their associations; environmental protection organizations (see Figure 2). These are the so-called 'stakeholders' of the system.

QI services are important for the elaboration, implementation and monitoring of technical regulations (TR), but also for process and product innovations (particularly metrology, testing and standardization). This means that, although it is important for ensuring a minimum quality for processes and products, strictly speaking, technical regulation is not part of the QI but is instead a client – a very important one – of the QI.

Figure 2

Quality Infrastructure Clients



Source: Prepared by Karl-Christian Goethner

Regulatory agencies are technical bodies – like QI bodies – but they perform political tasks. Regulatory agencies develop and implement TR. TR are mandatory, that is to say, they are imposed and controlled by the government. In essence, labelling programs are technical regulations. In principle, TR are based on international technical standards, which are sometimes adjusted and transformed into national technical standards. They define the characteristics and, in particular, the CAP for household electrical appliances based on the agreed energy efficiency criteria. Clearly, regulatory agencies do not only need the technical competence of the NSBs, but also the other components of the QI in order to be able to:

(a) draw up TR based on international standards and good practices that are tailored to the specific national context, and

(b) monitor and control compliance with TR in a reliable and comparable manner.

The regulatory agencies themselves or special agencies supervise compliance with technical regulations.

Sometimes in Latin America the words standards, regulations and technical regulations are used differently from those in other regions of the world, which can lead to confusion. To provide a better understanding of the use of these terms in the context of the QI, Box 2 explains the different technical terms and their content.

Box 2

Standards, Technical Standards, Regulations, and Technical Regulation

Box 2: Standards, Technical Standards, Regulations and Technical Regulations

In many countries the terms standards, technical standards, regulations and technical regulations do not correspond to international use. We will thus try to clarify the matter:

Norma (Standard):

Normas are not technical regulations. Internationally, a standard is developed by an ISO/IEC TC based on consensus among the different stakeholders participating in the work. ISO/IEC standards are voluntary. Due to the influence of legalese, in some countries, normas (standards) are erroneously considered as mandatory.

Norma Técnica (Technical standard):

To overcome the confusion in the use of the term "norma" in many Latin American countries, the term "normas técnicas" or "technical standards" is applied. It is identical to the term "standard" in international use. For example, COPANT, the regional organization for standardization, is called the "Pan American Commission for Technical Standards." ABNT (Brazil), ICONTEC (Colombia) and INTECO (Costa Rica) include the words "technical standard" in their names.

Reglamento Técnico (Technical Regulation)

Reglamentos técnicos define the minimum requirements for products and processes in order to protect health and environment. They are normally based on international standards. Reglamentos técnicos are mandatory. In some cases, they are formulated as a norma (in the abovementioned sense). One example is the *Norma Chilena de Electricidad* published by the SEC of Chile.

Normativa (Regulation)

A normativa has legal status and is quite different from a norma (técnica). Sometimes it is used instead of reglamento técnico.

Norma Obligatoria Méxicana - NOM (Mexican Official Standard)

The Mexican Official Standard is a standard developed by the different Mexican standardization bodies and is mandatory for Mexico.

Source: Prepared by Karl-Christian Goethner

The QI influences virtually all spheres of social and economic life. It contributes to economic and social development, improves quality of life and increases the productivity and economic efficiency of production processes. The following data exemplify this fact (see Box 3).

Box 3

Examples of the Impact of the QI

Box 3: Examples of the Impact of the QI

- A BIPM study conducted at the beginning of the millennium on the impact of scientific and industrial metrology revealed that one Euro invested in metrology yields approximately three Euros in return (Williams 2000).
- Studies carried out by the NIST, the US NMI, calculated that one dollar invested in metrology produced a return of up to $10.
- DIN calculations for the years 1950 to 2000 showed that 16% of GDP growth in Germany was thanks to standardization (DIN 2000). According to AFNOR, the contribution of standardization to the growth of French GDP was even higher, at 25% (AFNOR 2009).
- Fundación Chile has calculated that non-compliance with quality requirements for salmon in the North American market due to poor measurement resulted in losses of $198 million in six months.
- The introduction of the three coordinates measuring machine at Volkswagen is estimated to have increased the productivity of the production process by 30% (AFNOR 2009).
- A study by the World Bank indicates that in the first decade of this century, approximately 75% of the results of product tests carried out in developing countries were not reliable and needed to be repeated in developed countries, thus increasing product prices (World Bank 2007).

Source: Prepared by Karl-Christian Goethner

3. Quality Infrastructure for Labelling Programs

3.1 International technical standards and good practices form the basis of labelling programs

Energy efficiency programs include, most notably, MEPS and labelling programs for different products: electrical and gas appliances, cars, buildings, etc. Developing a MEPS and/or labelling program is a political decision resulting from international agreements and recommendations (such as COP 21, etc.) which are transformed into government policies. MEPS and labelling programs are underpinned by less visible technical procedures that determine the success of the programs (Figure 2).

Figure 3

Factors determining the success of labelling programs and MEPS

Source: Prepared by Sibylle Braungardt using CLASP materials

Labelling programs are developed and implemented by regulatory agencies that are usually part of or governed by the Ministries of Energy (for example, the Ministry of Mines and Energy in Colombia or the Superintendency of Electricity and Fuels, SEC, in Chile). Due to their mandatory nature, labelling programs correspond to technical regulations.[10] The regulatory agencies themselves or special agencies monitor compliance with the labelling programs. Supervisory agencies and bodies are technical entities that follow political guidelines. Technical regulations are generally based on international technical standards, which are often adjusted and transformed

[10] In some countries, the programs are voluntary to begin with and after a time become compulsory. In general, they are mandatory.

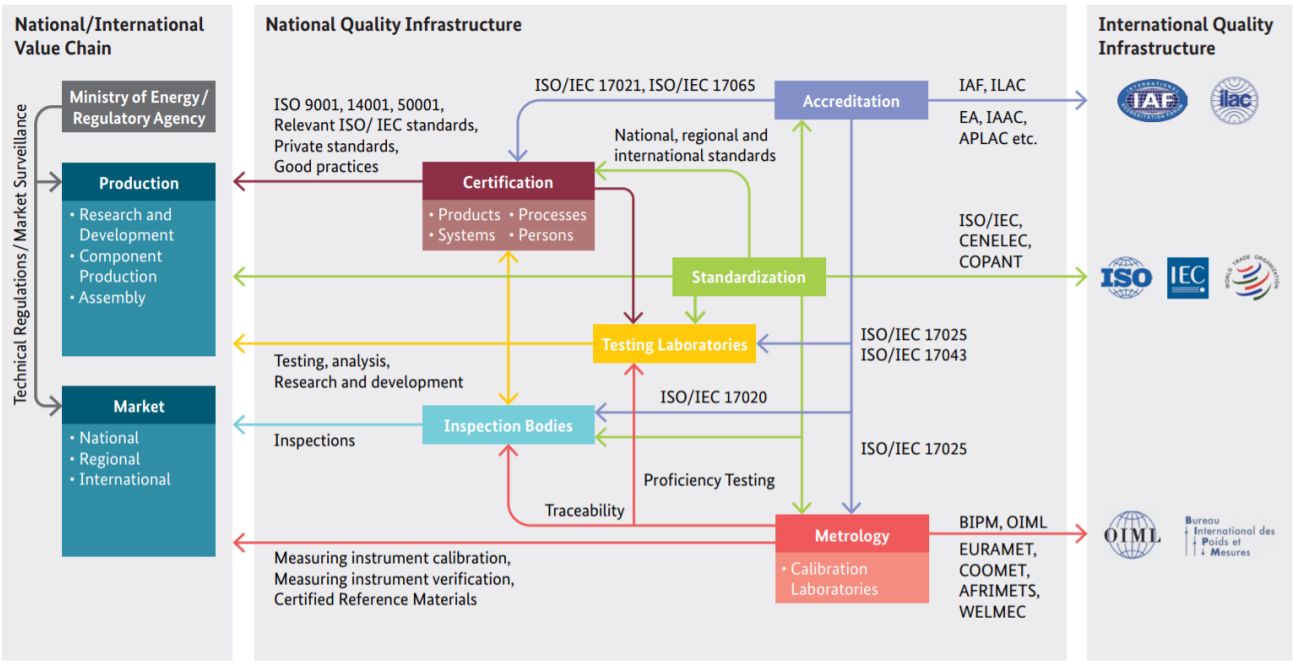
into national technical standards. These standards define the characteristics and, in particular, the Conformity Assessment Procedures (CAP) for household appliances.

As a general rule, regulatory agencies need the technical competence of the national standardization bodies (NSB) to fulfil their functions and develop labelling programs. However, technical standards and good practices alone are not sufficient to develop and implement realistic and successful labelling programs. The services of the entire QI are needed. If there is no QI in the country, or if it is only partially developed, the support of outside institutions is required. Nevertheless, each country needs regulatory and inspection agency officials with in-depth knowledge of how the QI and the conformity assessment procedures function.

Figure 4 shows the complexity of the QI and its interrelationships at both the national and international level. Standards and good practices are developed by the international bodies of the Quality Infrastructure (IAF, ilac, ISO, IEC, WTO, BIPM, OIML), which have counterparts in member countries of their organizations. Their relationships are based on mutual recognition agreements, on the standards developed by ISO/IEC and on good practices, often presented as guides. Services are provided throughout the value chain, from the research and development stage to the end consumer.

Figure 4

Quality Services for Labelling Programs



Source: PTB

Regulatory agencies – in this case for the household appliance sector – are based on the system and define (a) the minimum safety, health and environmental protection requirements, (b) the MEPS, (c) the CAPs and (d) the market surveillance and control system. Labelling programs normally include MEPS, CAP, market access requirements, and the market surveillance and control system. Sometimes they also designate accredited laboratories that can perform the tests.

3.2 International norms and standards as the basis for comparable measurements and tests

(a) General remarks

International standards that formalize the requirements with which a process or a product must comply are also important for the energy efficiency of household appliances. In principle, international standards are developed by the Technical Committees[11] of the two international standards organizations:

- ISO - International Organization for Standardization. It defines the standards for all areas except the electrotechnical and electronic sectors and telecommunications.[12] It has a Conformity Assessment Committee (CASCO), which develops the standards for the conformity assessment of products.
- IEC - International Electrotechnical Commission. It defines the standards for the electrotechnical and electronics industry.

In addition to these organizations, there is also the CIE, International Commission on Illumination, based in Vienna, which develops standards for light sources.[13]

Normally, it is the NSBs that have access to the international standards in force and disseminate them in their respective countries. If necessary, they convert them into national standards.

(b) The situation in Latin America and the Caribbean

All the countries in Latin America and the Caribbean, with the exception of Venezuela and Suriname, are full or corresponding members of the ISO. Some of the Caribbean Islands are affiliated members.

The Pan American Commission for Technical Standards (COPANT)[14] is the regional standardization organization. COPANT covers the entire American continent including the United States and Canada. The NSBs of 30 of the 34 countries in Latin America and the Caribbean are members, Venezuela is an adherent member.

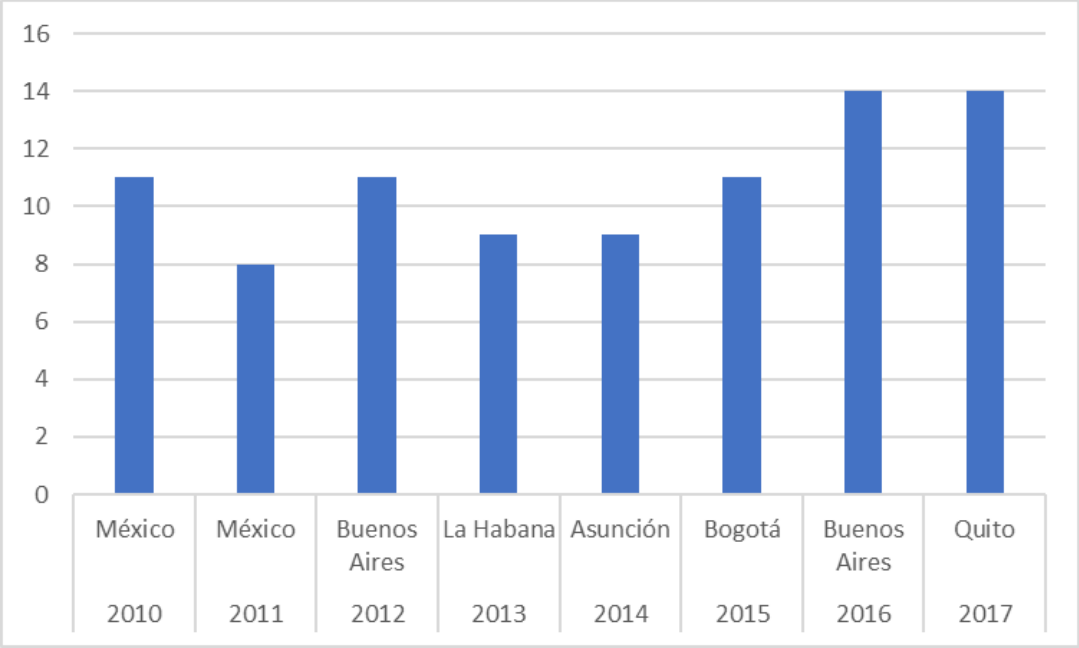
COPANT offers the countries of the region an instrument that can promote the harmonization of standards. After having developed regional standards for many years – by partially adjusting ISO/IEC standards to regional conditions, or developing some of its own standards – COPANT is now striving to improve the participation of Latin American and Caribbean countries in international standardization by the ISO/IEC. The COPANT TC 152 is dedicated to working on energy efficiency (see Fig. 5). As the only COPANT TC, it continues to develop its own standards on the grounds that ISO/IEC standards do not always correspond to the climatic conditions in the region. The COPANT energy efficiency standards published up to the end of 2018 can be found in Annex 6.

11 http://www.iec.ch/dyn/www/f?p=103:5:0##ref=menu
12 Telecommunications have their own standardization instrument: International Telecommunication Union - ITU
13 www.cie.co.at
14 "COPANT is the reference organization for technical standardization and conformity assessment in the countries of the Americas and their international peers, and promotes the development of its members." http://www.copant.org

In recent years, in the context of developing and implementing labelling programs, improvements have been observed in the relationship between regulatory agencies and NSBs. But there are still significant shortcomings. Very few countries have the necessary technical conditions, sufficient levels of interest on the part of industry and government and the financial means required to maintain strong and competent NSBs[15] that participate in international standardization. Only a handful of NSBs in large countries with more developed industries take part in a few TCs of interest to them.[16]

Figure 5

Participation of Latin America and the Caribbean countries in the annual sessions of TC 151/152



Source: Pablo Paisán (IRAM, Argentina)

One aspect of particular interest to labelling programs are the standards that define testing procedures for the energy performance of products. These standards are voluntary but can be declared mandatory by TR. As they are periodically reviewed and adjusted by the ISO and/or IEC TCs in accordance with technological advances and experience gained, TR must be formulated in a way that guides the current up-to-date standards without the need to make continual changes. The NSB TCs (which are Mirror Committees of the ISO TCs) are increasingly tending to stop developing their own standards and devote themselves to adapting and disseminating international standards.

ISO has a Committee on Conformity Assessment (CASCO) that works with its TCs to develop conformity assessment standards. Especially interesting are the product certification models summarized in ISO/IEC 17067: 2013. These models are apparently only applied in a few

15 Examples include IRAM (Argentina), ABNT (Brazil), ICONTEC (Colombia), INTECO (Costa Rica), ANCE (Mexico), UNIT (Uruguay)
16 The NSBs that participate in international standardization activities are IRAM, ABNT, ICONTEC and ANCE.

countries in the region (e.g. Chile).[17] COPANT has with good reason set up a CASCO Focus Group to work specifically on harmonizing conformity assessment procedures in the region, in accordance with international standards and good practices. This is important because direct participation in ISO standardization work by individual countries, particularly smaller ones with no domestic production of household appliances, is is sometimes diffcult and not ever necessary. The Focus Group gives them the opportunity to become informed and to transmit their priorities and interests along with relevant information. The recommendation is that governments should pay attention to and support, including with funding, the participation of NSBs in this work.

One important stakeholder in standardization within the electro-energy sector is, of course, the IEC, which is concerned with standards in the electro-technical and electronics sector, with particular emphasis on the safety of electrical products. It is also creating standards in the field of energy efficiency. In addition, it is developing its own testing laboratory certification scheme[18] within the scope of its IECEE committee. The aim is to produce a clear interpretation of the IEC standards concerning the necessary equipment, staff competencies and testing procedures, while ensuring the comparability of tests.[19]

IEC membership in the subcontinent is very diverse, which in a sense reflects the situation of the industry within the region. There are only six full members (Argentina, Brazil, Chile, Colombia, Mexico, and Peru) and one associate member (Cuba). The six full members have IEC National Committees. There are many difficulties still to be faced, especially when it comes to interest the private sector in participating in these activities and to secure sources of funding. To establish closer ties with Latin America and the Caribbean, the IEC has set up a Regional Office for Latin America (IEC-LARC).[20] IEC-LARC has five full members (Argentina, Brazil, Chile, Colombia and Mexico), one associate member (Cuba) and 25 affiliated countries.[21] Its membership is therefore similar to that of COPANT. There is also the Forum of IEC National Committees of the Americas – FINCA, which brings together the IEC national committees from the USA, Canada, Argentina, Brazil, Chile, Colombia, Mexico and Peru.[22]

In the area of lighting, CIE standards apply. Brazil is the only country from the region that is a member of this international organization.

At first glance, there appear to be countless organizations in Latin America and the Caribbean that are concerned with standardization. But all these organizations are part of the international system; in the case of electrical products, they belong to the ISO and IEC organizations. Within the region, there is close and growing cooperation between the different regional organizations, in particular COPANT, IEC-LACR and FINCA. The CASCO Focus Group and IEC-LACR provide platforms that enable Latin American and Caribbean countries to participate in international standardization.

(c) Summary

- Despite the fact that NSBs exist in virtually every country in the region, the issue of standards for energy efficiency needs greater attention from governments and industry, and from the entire private sector involved in this area.

17 This is the result of surveys conducted during the workshop entitled "Border Control and Market Surveillance: Instruments, Experiences, Lessons Learnt" held in Montevideo, from 11-13 September, 2018.
18 These laboratories must already be accredited by the respective NAB.
19 IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components. www.iecee.org
20 www.iec.ch/about/locations/iec-larc
21 https://blog.nema.org/2016/12/15/finca-and-copant-address-harmonization/
22 www.fincainfo.org/

- Since energy efficiency is an important issue on the international agenda and the relevant standards are developed by international standardization organizations, it is essential that the region's NSBs participate in this work. To fulfil this task, the NSBs need funding from both the public and private sectors.
- The interests and possibilities of each country depend on the market, whether or not there is domestic production, and other factors. Not all countries in the region have the opportunity (or the need) to participate in all international standardization work. This is why participating in COPANT activities and using the CASCO Focus Group and IEC-LACR platforms is important, since it provides sources of information on international trends as well as the chance to influence international standardization processes.
- To develop labelling programs, NSBs need a minimum number of personnel qualified in matters related to the necessary standards.

3.3 Metrology: Ensures accurate and comparable measurements

(a) General remarks

Metrology is the science of measurement. It is with us throughout our lives: measuring everything from our weight and size as a baby to the dimensions of our coffin. The most important measurement criteria are:

- Accuracy
- Reliability
- Comparability and
- Repeatability.

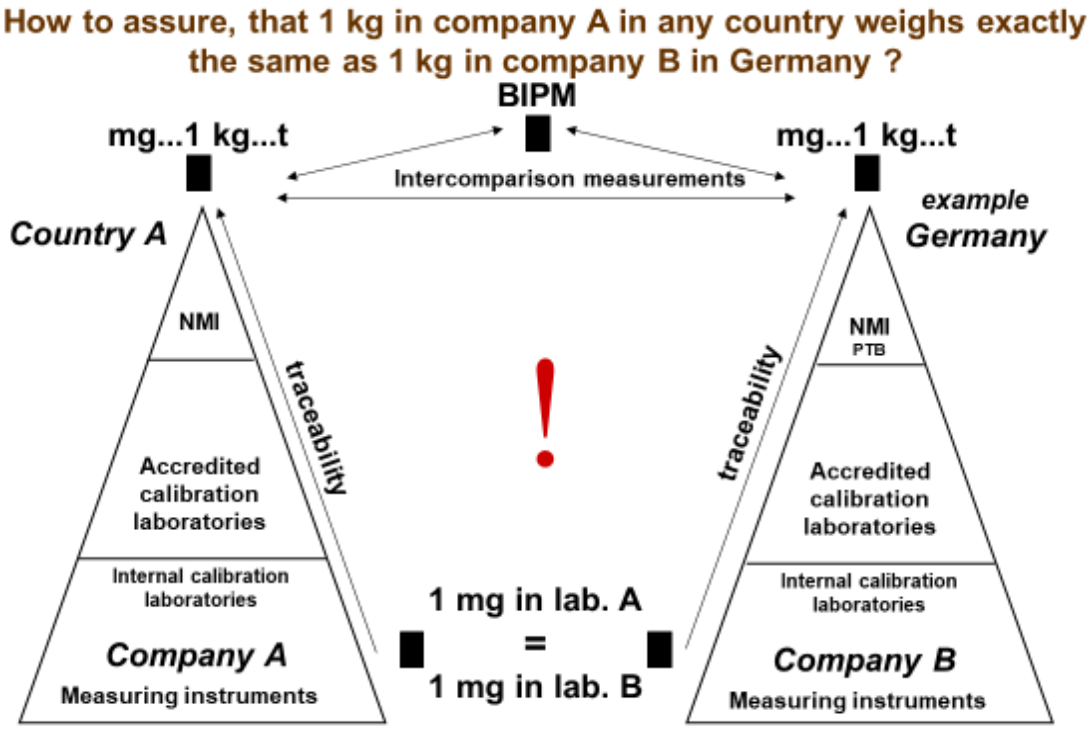
Together with the standards that define the characteristics of products, processes and quality management systems, correct and comparable measurements form the basis for producing products of the desired quality and verifying whether or not those products meet the desired requirements on energy efficiency criteria.

The reliability and comparability of the measurements is ensured by the International System of Units (SI) and its main quantities.[23] All measurements refer to these quantities. This is achieved using an uninterrupted chain of calibrations from the most accurate measurement standards at the NMI level to secondary calibration and testing laboratories and measurement instruments used in industry (see Fig. 4). The SI was created in 1875 through the Metre Convention, with the BIPM[24] as its governing body. In 1999, the CIPM Mutual Recognition Agreement (CIPM MRA) was adopted, whereby the signatories define the rules governing the comparability and reliability of measurements.[25]

23 The International System of Units (SI) includes the following basic quantities: mass (kg), length (m), temperature (k), time (s), electrical current (a), amount of substance (mole), luminous intensity (cd)
24 www.bipm.org
25 The member states in Latin America and the Caribbean are: Argentina, Brazil, Chile, Colombia, Mexico and Uruguay. The associated countries are: Bolivia, CARICOM, Costa Rica, Cuba, Ecuador, Jamaica, Panama, Paraguay and Peru. The Central American countries of the Dominican Republic and Venezuela do not participate.

Figure 6

Traceability of measurements. Example of Mass kg)



Source: Prepared by PTB

The members of the BIPM/CIPM are the National Metrology Institutes (NMI), which are responsible for developing and disseminating metrology in their countries. NMIs are the highest national authorities on metrology. They have to maintain and develop their technical measurement skills in line with the advances in international metrology. They must therefore participate in regional and global meetings of metrological organizations and in intercomparisons with other NMIs from the region and throughout the world to test and improve their competence at exact measurements, registered as Calibration and Measuring Capabilities (CMCs by the BIPM).[26] They deliver the quantities through calibrations for clients in the country. NMIs receive international recognition for their quality management systems and the technical competence of their laboratories through peer assessments carried out by SIM. The costs have to be paid by the NMI. In some cases, if the laboratories do not have primary standards, they are accredited by foreign NABs (DAkkS, Ukas, ANSI, etc.).

26 The NMIs' measurement skills, what are known as their "calibration and measurement capabilities-CMC", are registered in a BIPM database, the "BIPM key comparison database": https://kcdb.bipm.org/

According to the criteria given by Musgrave & Musgrave (1973), scientific and industrial metrology is a public good (ECLAC, 2012):

- The fixed costs of safeguarding and the costs of developing national measurement standards that ensure traceability to the International System of Units are extremely high (measurement standards, environmental conditions, qualified personnel).
- Access to national measurement standards must be ensured for all users (consumers, large companies, SMEs, regulatory agencies, R&D&i bodies, etc.). It must not be exclusive or monopolized.
- There is a need for impartiality and integrity with regard to measurements.

NMIs must have a guaranteed amount of funding in the state budget. The cost of an NMI is quite high and cannot be covered by the income obtained from the services offered. The PTB in Germany and the NIST in the US are over 90% financed by the state budget and public projects.

(b) The Situation in Latin America and the Caribbean

The countries of Latin America and the Caribbean belong to the Inter-American Metrology System (SIM),[27] which brings together all the NMIs from the continent, including the USA and Canada. In order to be able to operate in line with the different regional needs, SIM has sub-networks for the various parts of the continent: NORAMET (USA, Canada, Mexico), CAMET (Central America), CARIMET (Caribbean), ANDIMET (Andean Countries) and SURAMET (Southern Cone). SIM and the sub-networks organize metrology work in Latin America.

The level of the NMIs is heterogeneous. The leading NMIs in LAC are those of Argentina, Brazil, Colombia and Mexico, which are middle-level organizations in international terms. They have many laboratories with high Calibration and Measuring Capabilities (CMCs) and are internationally recognized through peer assessment. There are other NMIs that have fewer internationally recognized laboratories (for example Uruguay, Peru, Ecuador or Costa Rica) and finally NMIs that are still in the early stages of development.

In the case of the energy efficiency of household appliances, the following quantities are important:

- electrical quantities,
- mass,
- length,
- temperature,
- humidity,
- photometry (for lighting),
- torque (for motors).

In terms of the technical competences of the NMI laboratories in LAC, the regional situation with regard to electrical quantities, mass, length and temperature is relatively good, despite the fact that not all NMIs have access to the necessary measurement ranges. Far more problematic is the situation with regard to humidity and in particular photometry. Only INTI (Argentina), INMETRO

27 https://sim-metrologia.org/

(Brazil) and CENAM (Mexico) have photometry laboratories that are recognized through peer assessment by SIM.[28] Cooperation with NMIs within and beyond the region would be advisable.

With the exception of a few countries such as Brazil, Costa Rica, Uruguay or Colombia, inadequacies have been observed in the development of labelling programs due to the fact that the technical competencies of the NMIs were not given sufficient consideration during the program development phase. Above all, this has led to technical problems with conformity assessment procedures and market surveillance and control.

(c) Summary

- Metrology is the basis for accurate, reliable and comparable measurements and tests, which are needed to ensure the energy efficiency of products. Although virtually all the countries of the region have NMIs, their importance has often not been given due consideration when developing labelling programs.
- The situation in the region is adequate in terms of a series of quantities that are essential for measuring energy efficiency: electrical quantities, mass, length, temperature, torque (for engines). Many NMIs have recognized laboratories or ones that can ensure traceability with the help of neighbouring countries. The situation with regard to humidity and in particular photometry is problematic. Only INTI (Argentina), INMETRO (Brazil) and CENAM (Mexico) have photometry laboratories that are recognized through peer assessment by SIM.
- The lack of recognition of the importance of NMIs is also reflected in the very low level of funding. Metrology is a public good and must be maintained and developed primarily by the state budget in accordance with the needs of the country.
- Since metrology is quite expensive, close cooperation is required between the countries of the region to ensure the traceability and accuracy of measurements according to requirements.

3.4 The role of accreditation

(a) General remarks

Accreditation is the instrument used to demonstrate the technical competence of CABs, that is, of secondary calibration laboratories, testing laboratories, certification bodies and inspection bodies. The international system is run by two organizations:

- International Laboratory Accreditation Cooperation – ILAC, which organizes the mutual recognition network among national accreditation bodies in the case of calibration and testing laboratories [29]
- International Accreditation Forum – IAF, which organizes the mutual recognition network among national accreditation bodies in the case of certification and inspection bodies.[30]

28 The situation in 2016 is described in the following document: https://www.nist.gov/pml/sim-quality-system-documentation
29 www.ilac.org
30 www.iaf.nu

In the context of energy-efficient household appliances, it is important that the national accreditation bodies (NAB) possess structures, technical competence and quality management systems compliant with ISO/IEC 17011 and recognized by ILAC/IAF or one of the regional accreditation organizations. Once they have been recognized, the bodies must demonstrate, through peer assessment, their ability to accredit the different CABs (see Table 2). In the case of energy efficiency, some additional knowledge is required, for example, on testing standards for household appliances.

Table 2

Important standards in the area of product energy efficiency

Standard	Recognition of technical competence
ISO/IEC 17011	National Accreditation Bodies
ISO/IEC 17020	Inspection bodies
ISO/IEC 17021	Management system certification bodies
ISO/IEC 17024	Certification bodies for persons
ISO/IEC 17025	Calibration and testing laboratories
ISO/IEC 17043	Proficiency testing providers
ISO/IEC 17065	Product certification bodies
ISO/IEC 17067	Fundamentals and guidelines for the design and content of product certification schemes

Source: Prepared by PTB

(b) The situation in Latin America and the Caribbean

The regional accreditation organization that cooperates with both ILAC and IAF is the Inter-American Accreditation Cooperation (IAAC - https://www.iaac.org.mx/index.php/en). The IAAC covers the entire American continent from the United States to Chile and Argentina. It has 19 full members and two associate members. The IAAC recognizes the technical competence of NABs through peer assessment in accordance with the different standards (see Table 2), thereby enabling them to sign up to the respective MRA/MLA. The standards are developed by ISO CASCO in cooperation with ILAC and IAF. So far, 15 countries in the region have signed MRAs/MLAs, including 14 MRAs for testing laboratories, nine for product certification bodies and three (Argentina, Brazil, Mexico) for PT providers (see appendix 4).

Some of the NABs are more experienced, such as those in Argentina, Brazil, Mexico, Uruguay or Costa Rica. ONAC of Colombia is also moving in this direction. Most of the other countries have not yet acquired much experience with CAB accreditation for testing and certifying household appliances. The household appliance industry is present in just a few countries and the number of independent technical experts with experience in accreditation, not employed by industry laboratories, is limited. It will take time to train and to improve the skills of the technical experts to ensure a level of work quality that is comparable to other regions. One critical issue is proficiency testing (PT) or Robin Round Tests (RRT), which is to say, comparisons of measurement and testing capabilities between different calibration and testing laboratories. The shortage of accredited PT

providers in LAC (two in Brazil, two in Mexico) limits the possibilities for improving publishing and testing methods through inter-laboratory comparisons led by competent providers. To improve this situation, in some countries, regulators are organizing national intercomparisons with the support of NABs but without the involvement of providers. It is a help, but the results are clearly not as accurate as those that can be achieved by PTs run by accredited providers.

As in the case of the NMIs, the competence of the NABs and in particular their knowledge of the competence of the CABs was not sufficiently taken into account in many of the implementation activities included in the labelling programs.

(c) Summary

- The number of NABs is small. Furthermore, in most cases their experience in the field of CAB accreditation for household appliances is quite recent. Experienced and independent technical experts are in short supply.
- One obstacle hindering the accreditation of testing laboratories is the low number of PTs, which are one of the conditions for accreditation. Proficiency testing providers are also in short supply. This has an impact on the certification processes.
- In many countries, NABs are not sufficiently involved in the process of developing and implementing labelling programs, despite the fact that they should be very familiar with the technical competence of the CABs.

3.5 Conformity Assessment Procedures (CAPs)

(a) The situation in Europe

The key element when it comes to developing and implementing labelling programs is the conformity assessment of household appliances. Conformity assessment:

- demonstrates that products comply with the standards and definitions established in the labelling programs, based on tests carried out in competent ISO/IEC 17025 accredited laboratories;
- issues product certificates in accordance with international rules issued by ISO/IEC 17021 and ISO/IEC 17065 accredited certification bodies.

In Europe, in terms of energy efficiency, product access to the EU market is regulated by Directive 2009/125 EC.[31] The Directive includes a self-declaration by the producer, which means that all CAPs are carried out by the companies' own testing laboratories ("first party laboratories"). Many companies often hire world-renowned accredited laboratories to ascertain whether their laboratories conform to international standards and good practices. The functions of the "third party" laboratories, in other words, the independent testing laboratories within the industry, in the post- and pre-market phases are shown in Fig. 7.32 Another measure is Robin Round Tests, which

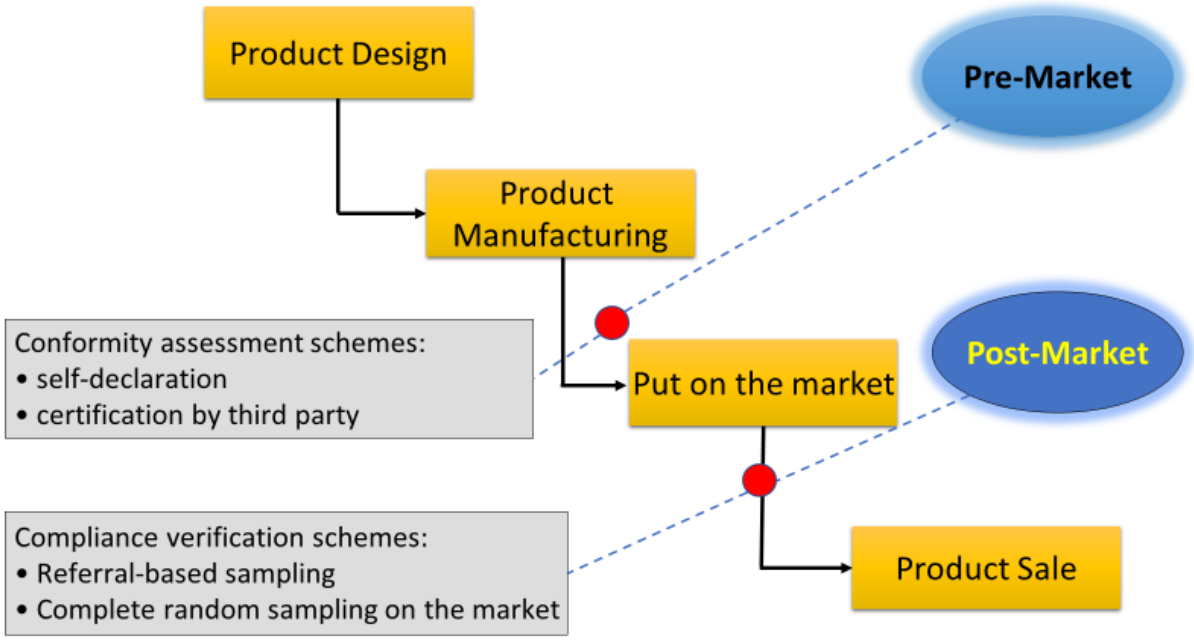
31 DIRECTIVE 2009/125/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 establishing a framework for the setting of eco-design requirements for energy-related products. See: https://eurancla/legal-content/ES/TXT/PDF/?uri=CELEX:32009L0125

32 There are three different types of laboratories: so-called first-party laboratories belong to industrial companies; second-party ones belong to purchasers (commerce), while third-party laboratories are independent.

are intercomparisons (PTs) between the different household appliance testing laboratories, normally run by a laboratory operating as a third party.

Figure 7

The role of third-party labs



Source: Christoph Tuerk, VDE-Institut, Offenbach (Germany)

Of course, when the regulatory agency is developing the labelling programs, it must consider whether or not there are any accredited testing laboratories and certification bodies with the technical competence to carry out this work in the country. If this is not the case, competent and reliable conformity assessment bodies (CAB) must be sought abroad.

(b) The situation in Latin America and the Caribbean

In Latin America and the Caribbean, the issue of CAPs is highly complex and complicated for two reasons:

First, although it is true that COPANT CT 152 has decided to follow ISO/IEC standards, two different systems of standards are applied in parallel according to market requirements:

(1) ISO/IEC standards and
(2) ASTM standards and a number of other North American and Canadian standards, some of private nature.

This is not the only case in the world where two different types of standards have been applied. In post-Soviet countries, the GOST standard is still applied in tandem with the ISO/IEC standards; however, in many cases the two standards already overlap. In Latin America and the Caribbean, the coexistence of different types of standards is due to the fact that in the North American market,

which is important for the region's imports and exports, the ASTM standards dominate. In contrast, most countries in the rest of the world apply ISO/IEC standards. Labelling programs differ, then, in terms of their reference standards and equivalent standards. In South American countries, the reference standards are primarily ISO/IEC but in Mexico, Central America and Colombia ASTM standards are used, often in the form of the Official Mexican Standard (NOM) guided by ASTM standards (see Fig. 8). Therefore, in the South of the region, the equivalent standards are the ASTM ones while in the North they are ISO/IEC standards.

Figure 8

Application of ISO/IEC and ASTM, CSA and other North American Standards in Latin America and the Caribbean

Source: Prepared by Karl-Christian Goethner

The dilemma is that they are not equivalent because the methods and parameters used by the standards do not coincide, meaning that the test results are not comparable. This can be seen when comparing the standards for washing machine tests (see Table 3).

Table 3

Differences between IEC and CSA test standards

Item	CSA-C 360	IEC 60456
Energy test garments	50% cotton 50% polyester	Pure cotton
Floors	N/A	Swisatest 105
Reference machine (standard)	Not necessary	Wascator CLS
Water hardness	0.5 +/- 0.02 mmol / L	2.5 +/- 0.2 mmol / L 0.5 +/- 0.2 mmol / L
Test load conditions	22°C +/- 2°C	20°C +/- 2°C ambient temperature 65°C +/- 5°C relative humidity
Test cycle	3 machines	1 machine, 5 cycles
Detergent	Not necessary	IEC A *
Water meter res.	0.4 L +/- 2%	0.1 L +/- 1%
Performance	**Not necessary**	**Yes**

CSA – Canadian Standards Association

Source: Christoph Türk, VDE Testing and Certification Institute (Germany)

Second, there are not enough accredited testing laboratories with the necessary experience to carry out the tests to the required level of technical competence. Laboratories are important before releasing products onto the market ("pre-market" phase) to ensure that appliances meet the energy efficiency requirements. They also play an important role in the market surveillance process ("post-market" phase), by checking whether the performance of the products sold on the market coincides with the documentation and indications on the label (see Figure 7 and chapter 3.6).

Maintaining and developing accredited testing laboratories is very expensive. The testing and measurement equipment for the different types of products, periodic calibrations of measuring instruments, environmental conditioning (temperature and humidity in particular), training and continuous technical improvement of personnel, participation in intercomparisons (PTs), accreditations and their renewal represent very high costs that must be offset by the services provided. Considering the potential demand for testing, it is not very cost-effective for each country to have the full range of laboratories necessary for the conformity assessment of household appliances. It makes sense in countries with domestic production and developed markets like Argentina, Brazil or Mexico, but not in every Caribbean island state, for example. This requires sub-regional and regional cooperation and sometimes also cooperation with reputable accredited laboratories outside the region.

Due to the failure on the part of governments and regulatory agencies to grasp their importance, the lack of competent testing laboratories is the most important bottleneck in the implementation of labelling programs in the region. This is not the case in Brazil, where there is a fairly well developed QI and a long tradition of labelling programs, or in Argentina or Mexico. Uruguay is one of the countries where the situation has improved considerably. The ICE in Costa Rica now has an energy efficiency laboratory that can meet the demand for tests for the whole of Central

America with the possible inclusion of the Caribbean and Venezuela. Colombia has developed a program to improve the quality of testing laboratories involved in developing the RETIQ, with the support of the UNDP and PTB. It now has six accredited first- and third-party laboratories. Chile is currently implementing an en.lighten project with the aim of improving the technical competence of lighting testing laboratories across the board. A refrigerator program is also being developed.[33]

Despite all the progress made in recent years, and bearing in mind the afore mentioned shortcomings, the situation of many laboratories is still precarious, which hinders their ability to achieve comparable and reliable results.

The situation is not very satisfactory either with regard to certification bodies. In the case of product certificates, ISO 17065 accreditation is required, with some specific knowledge of energy efficiency. In some countries, the certifiers have their own accredited testing laboratories. In others, however, the certifiers (for example, IRAM in Argentina) hire laboratories appointed by regulatory agencies. In many countries, large international certifiers (TÜV, SGS, Bureau Veritas, etc.) dominate the business. There are a few major national certifiers in the form of NSBs that have certification services (e.g. IRAM, ICONTEC) or independent certifiers (NYCE in Mexico or CIDET in Colombia). One very important issue is the mutual recognition of certifications and the issuing of certificates and documentation for products in accordance with the models defined by ISO CASCO.

(c) Summary

- Conformity assessment is a key aspect of developing and implementing labelling programs. In many cases, insufficient consideration is given to its importance and the costs involved.
- The main bottleneck is the lack of competent, experienced, ISO 17025 accredited testing laboratories. The main shortcomings of the testing laboratories are: the lack of adequate equipment, unstable environmental conditions, the lack of participation in PT, the lack of availability of competent and experienced personnel and staff fluctuation. Furthermore, there is a lack of funding to improve facilities and train personnel.
- To improve the situation of laboratories, particularly in countries with large markets and domestic production of household appliances, it would be advisable to introduce laboratory development programs co-financed by the state.
- There are few national certifiers in each country. The market is dominated by large international companies (TÜV, SGS, Bureau Veritas, etc.). There are some NSBs with important certification services (IRAM [Argentina], ICONTEC [Colombia]) and a few independent institutions (NYCE [Mexico], CIDET [Colombia]).
- Implementing, maintaining and developing competent, accredited testing laboratories is very expensive. Due to the level of demand, it does not make sense economically for each country to set up laboratories for every type of household appliance. Closer cooperation is needed, both within the region as well as with accredited and recognized laboratories outside the region.
- There are a number of difficulties in using the capabilities of competent testing laboratories in neighbouring countries. The process takes time (transportation!), there is a lot of red tape involved (export and import permits, taxes) and the products to be tested run the risk of being damaged.

33 According to information from the Fundación Chile

3.6 The importance of the Quality Infrastructure for border control and market surveillance

Border control and efficient market surveillance are essential for the successful implementation of labelling programs. Implementation plans must include these important elements. The QI plays a significant role here in supporting monitoring activities.

(a) Market entry and border control

Household appliances entering the market may be

(a) produced in the country or
(b) imported from other countries.

In case (b), customs, together with the foreign trade authorities and QI institutions, have to carry out important activities to ensure that the labelling program regulations are implemented:

- Check import papers and technical documentation;
- Check labels to prevent products from entering the market without a label or with an incorrect label;
- In some countries (e.g. Argentina, Brazil) samples of imported lots are taken for testing by national laboratories designated by the authorities.

Obviously, the customs and import agency officials in charge need to be well versed in the technical regulations and procedures, and know whether the certificates and documentation comply with these regulations and international standards. This job requires regular training and updating in the regulations and in the interpretation of certificates and documentation, as was implemented in Colombia for example when RETIQ was introduced (see Box 4).

In some countries, foreign certificates are recognized under certain conditions (product certificate that complies with international standards, there is no competent laboratory in the country, there are mutual recognition agreements with a national certifier, etc.). Other countries (e.g. Argentina) require that the access to the market of imported goods needs a type approval carried out by a national testing laboratory. Brazilian regulations require a sample of imported lots to be tested. Competent ISO 17025 accredited testing laboratories, as well as a ISO 17065 accredited certification body, are needed for this purpose.

Box 4

Personnel training during the process of implementing RETIQ in Colombia

Inter-institutional workshop for stakeholders:	53 participants
Customs (DIAN) personnel training:	499 participants in 12 cities
SIC (surveillance) personnel training:	79 participants
SENA personnel training:	45 instructors
Environmental authorities	47 participants
Training of technicians from 46 laboratories:	221 participants

Source: UPME, 2017

Close cooperation is needed between regulatory agencies, customs, foreign trade authorities and QI institutions, particularly standardization, accreditation and CABs.

To facilitate this work, it could be very useful to set up databases of products and certificates, as is done in Uruguay and Chile, for example. Coordination and harmonization of these data banks among the countries of the region could facilitate entry controls for imported electrical products.

(b) Market surveillance

Market surveillance is an indispensable element of every labelling program. A distinction can generally be made between

i.) Market inspections
ii.) Product checks using samples taken from the market
iii.) Complaints and other instruments.

Given that in many countries there are hundreds of labelled products, it is necessary to prioritize the categories that will be controlled. Another reason are the costs, which are very high, especially in the case of tests. The method recommended but not often applied is risk analysis, used to evaluate the negative impact certain products might have in terms of safety and energy consumption in the country. It can also be used to develop a market control plan.

(i) Market inspections

These are used to monitor the correct application of labels and are implemented in many countries. There are two methods:

1. Checking whether the label complies with what the labelling program requires and is in a visible location. It is the simplest, cheapest and most widely used method. Non-compliance is penalized; and
2. Checking whether the product label matches the certificates and documentation stipulated by the labelling program. It is more accurate and requires greater knowledge on the part of officials. Non-compliance is penalized.

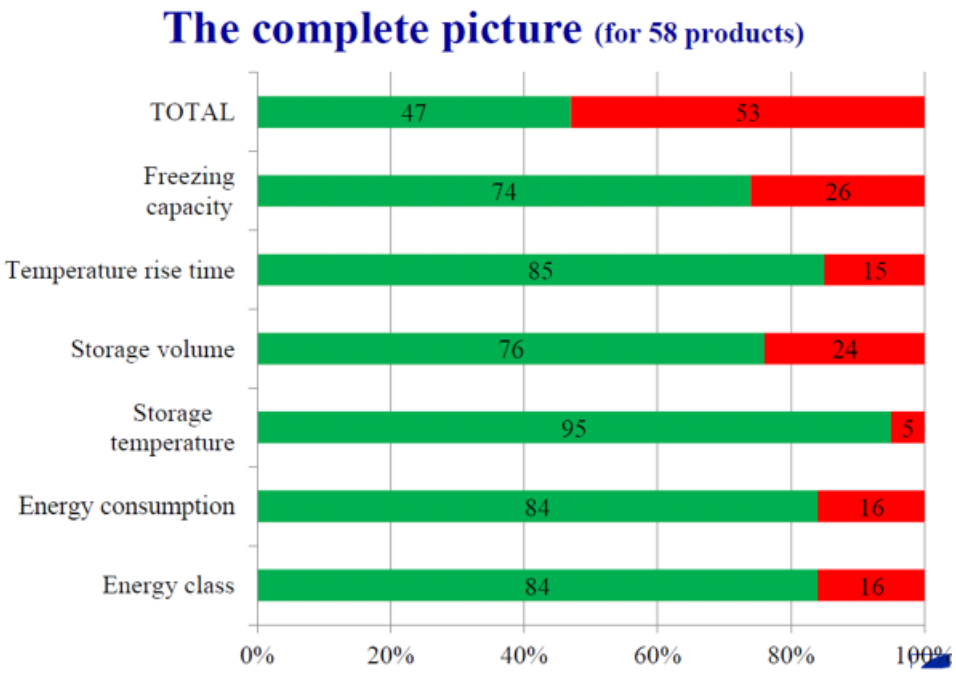
(ii) Verification of electrical products by competent testing laboratories

This is the most complex and expensive method and is therefore rarely applied. Appliances are purchased on the market (sampling) and are allowed to be tested by accredited and experienced laboratories. There are only a few such examples in Latin America and the Caribbean. One is the tests carried out by INTI on incandescent lamps.

In the European Union, tests of samples purchased on the market have been carried out with the Atlete I and II projects. In the case of the Atlete I project, almost 25% of the refrigerator models tested did not meet the energy consumption parameters indicated on the label (above the tolerance of 10%). This shows the importance of regularly testing these characteristics (see Figure 9). Atlete III is currently being prepared. Non-compliance is penalized.

Figure 9

Results of Atlete I (tests on refrigerators purchased on the market)



Source: Juraj Krivošik (SEVen)

In 2006 in Latin America, INTI (Argentina) carried out tests on 26 low-energy consumption lamps (fluorescent ones in this case) from different producers, with very interesting results. According to the INTI tests, the useful life of the lamps entering the country was between 30 and 60% less than that declared on the label, equivalent to between 50 and 60% of the stated electrical power. The consequences were:

- An improvement in market control based on Provision 86/2007 issued by the National Directorate of Internal Trade (Energy Labelling based on IRAM 62404-1 and IRAM 62404-2, CIE 84 standards) and in particular
- An improvement in the technical competences of four testing laboratories, which with technical assistance from INTI were enabled to assess conformity in accordance with the

ruling technical regulations (measurement of luminous flux, electrical parameters and ageing of large quantities of lamps).

A second study in 2013 showed that controls on energy labelling on lamps has helped create a barrier for those lamps that do not meet minimum energy efficiency standards. Certain lamps that had produced alarming results in Stage I can no longer be marketed in Argentina, meaning that consumers can now purchase more efficient CFLs.[34]

(iii) ***Complaints and other instruments***

Consumer protection institutions such as the Stiftung Warentest in Germany play an important role by regularly testing the performance of household appliances. INTI is also doing the same, as explained above.[35]

Another instrument is consumer complaints. The entities that consumers can be turn to include INDECOPI (Peru), SERNAC, SEC (Chile) and SIC (Colombia)

In the US, market surveillance is carried out differently. Competitors or consumer associations purchase the products and test them; and when they find that the product performance is not up to the standard indicated on the label, they report the company. If the complaint is confirmed, the company is taken to court and has to pay a very large fine.

34 Saavedra 2017
35 INTI 2013

Table 4

Border Control and Market Surveillance Instruments in Latin America and the Caribbean

Principal Activities	Instruments	Objective	Observations	Apply*)
Border control	Control of the import documentation, the technical documentation and the label	Obviation that bad or falsificated products enter the country	Customs is not sufficiently included in the labelling programs	
Technical control before entering the market	Control if the label exists before entering the market	Obviation that products enter the market without label or non-correct label		UY
	Product tests realized by national laboratories before they enter the market	Obviation that products enter the market which are not accomplishing the TR of EE	In some countries it is mandatory. Some countries do not recognize foreign certificates	AR, BR, CL and others
Inspections on the market	Risk Analysis	Prioritization of the products which have to be controlled first	Because of the efficiency (costs) products of more risk for consumers are controlled. Few application.	CL
	Control of the label and its position	Visibility, correct label, correct position of the label	Easy and simple control. Controlling authorities have to be trained for this work	AR, BR, CL, CO, JM, MX, PA, PE, PY SV, TT, UY
	Control of the conformity of the label with the technical documentation	Proved conformity of product, label and technical documentation	Requires high technical competences	
Verification of products	Taking samples in the market and testing them	Verification if the performance of the product is according to the technical documentation and the label	The most precise, but also the most costly instrument. Periodically applied	BR
Others	Complaint by other producers	Using the competition between the producers	The costs have to be payed by the denounced enterprise if the complaint is correct	CL, CO
	Complaint by the consumers.	Inclusion of the consumers in the quality control process	Some countries have institutions for this purpose.	CL, CO

Observation: (*) not complete, only examples

Source: Prepared by Karl-Christian Goethner based on information received during the Workshop "Border Control and Market Surveillance: Instruments, Experiences, Lessons Learnt" held in Montevideo, from 11-13 September, 2018.

(c) Summary

- Border control and market surveillance of household appliances are critical elements in the implementation of labelling programs. Trained personnel are needed in the customs authorities, the bodies that grant import permits and in the entities that carry out market surveillance.
- Another important element is the rules (standards) for taking samples and the respective tests, since the results depend on these procedures.
- There are three main methods of market surveillance: (1) inspections to (a) check whether the label complies with the definitions of the labelling program and is in a visible location and (b) verify whether the product label matches the certificates and documentation defined by the program, (2) purchasing household appliances on the market (taking samples) and testing them according to the technical reference standards in force (this is the most detailed and expensive method) and (3) complaints by consumers and manufacturers along with activities carried out by consumer protection organizations.
- The services of the QI are necessary to be able to evaluate product certificates and documentation and to enable household appliances to be tested.

3.7 Consumer engagement in standardization work, regulation and market surveillance

(a) General remarks

End consumers make up a very important stakeholder group for labelling programs. In order to take their points of view into account when carrying out standardization work, regulation and market surveillance, it is necessary to provide them with a space where their opinions can be heard. The ISO, the WTO and other bodies associated with technical standards and regulations have determined that each national and international standard and each technical regulation must be published electronically for a public consultation period of six months, to enable every consumer and consumer protection agency to express their opinions and criticisms and put forward proposals. The Standardization TCs are also open to participation by consumers and their representatives.

Despite these regulations, consumer involvement is often low. This has to do with two basic problems:

(1) The work carried out at consumer protection organizations is usually voluntary and unpaid. Funding is often in short supply.
(2) Consumer protection agencies cannot usually count on the participation of experts and technicians, largely due to the lack of funding.

In Germany, the problem of market surveillance is partly resolved by the aforementioned Stiftung Warentest, which is funded from the German state budget, enabling it to maintain its independence. The other instrument is the Consumer Council, which has its administrative office in the DIN and attempts to participate in the standardization work of the DIN, CEN / CENELEC and ISO. One positive element is that German consumers have access to a lot of information on product quality. Quality is an important aspect of their purchasing decisions.

(b) The situation in Latin America and the Caribbean

In Latin America and the Caribbean, the household appliance market is largely based on price rather than quality. Buyers often do not have enough money to purchase a more energy-efficient model. Neither do they have sufficient information provided either by the media or vendors. This is due to the lack of training for sales personnel and their incentive to make a sale, since their salaries depend largely on their sales levels. Thus, consumers are often unaware that after using the appliance for a certain time, the energy wastage may exceed the additional amount they would have paid for a more expensive but more efficient product.

Another important aspect is that consumer protection organizations are very weak and have not been established for very long. They are gradually being strengthened in various countries (Argentina, Chile, Colombia and Peru, to name a few) but appear to be focused on other more urgent problems: bank costs, pollution problems or commercial scams, for example.

There are some institutions such as INMETRO in Brazil, INDECOPI in Peru or SERNAC in Chile that are developing channels through which consumers or their associations can participate in monitoring the performance of household appliances. An interesting example is that of Chile, where:

(a) The Ministry of Energy has set up a Civil Society Council – COSOC, which participates in formulating the Ministry's regulations and directives; and

(b) The Superintendency of Electricity and Fuels (SEC) has set up a Civil Society Council and a Safety Board in which consumer organizations participate. Recently, these organizations have also had the possibility to propose draft regulations.

Nevertheless, consumer engagement in the elaboration and monitoring of technical regulations is generally insufficient and must be strengthened in the coming years. This will require consumer awareness campaigns, more informational materials (Fig. 10) and an improvement in the financial base of the newly emerging consumer protection organizations.

Figure 10

Examples of Consumer Information

AchEE (Chile) material on energy use in residential homes

INTI material (Argentina) on the quality of the different types of energy saving lamps

(c) Summary

- In Latin American and Caribbean countries, the market is still based on price rather than quality. This has consequences for consumers' purchasing decisions. With few exceptions, there continues to be a lack of consumer awareness campaigns and informational materials.
- In most countries, consumer protection organizations are weak and do not have the financial means to participate more actively in standardization, regulation and market surveillance processes. Another gap is access to technical experts willing to support their work, which is usually unpaid.

- In some countries, attempts are being made to involve consumers in standardization, regulatory and surveillance work. In Chile, for example, the Ministry of Energy and the SEC have put in place Civil Society Councils, which have the chance not only to influence legislative and regulatory work, but can also propose regulatory bills.

4. Harmonization and Cooperation Opportunities in Latin America and the Caribbean

The task of tackling climate change, reducing greenhouse gas emissions and protecting limited natural resources is a very complex endeavour that requires the cooperation of all the countries of the world. The same applies to improvements in energy efficiency, as one of the most important instruments for achieving the objectives defined by the various global conferences, particularly COP 21 and the Paris Agreement. In terms of the situation in Latin America and the Caribbean, there are several regional institutions that are concerned with energy issues, particularly OLADE and ECLAC, and support governments in developing and implementing energy policies in a bid to help meet the Sustainable Development Goals (SDG) within the framework of the 2030 Agenda.

When it comes to energy efficiency policies and programs, and in this context especially to technical regulations and product labelling programs, one of the challenges is to consolidate and improve the effectiveness of the institutions responsible for the QI. These institutions, with their technical competence, form an essential basis for developing, implementing, and monitoring such policies and activities. However, it is possible to identify two shortcomings that hinder the linkage between energy policy and regulation, on the one hand, and QI institutions on the other:

(1) With few exceptions, there is a lack of effective communication between energy policy, regulation and the QI. In many cases, politicians are not aware of the importance of the QI's technical competencies for facilitating the successful implementation of technical regulations and labelling programs.
(2) The QI institutions do not have the adequate technical preparation to offer the services needed to meet the requirements of these programs. Furthermore, the requirements are so broad that it is neither possible nor necessary for each country to have a complete QI that can guarantee compliance with the MEPS and labelling programs, especially with regard to the conformity assessment of products.

It is clear that a substantial improvement in the levels of regional cooperation and integration in the field of regulation, and specifically with regard to the QI, can generate very positive impacts that reduce costs and increase the effectiveness and efficiency of the activities implemented.

The situation with regard to the QI is promising, since the QI bodies are already grouped into regional organizations. These organizations include the United States and Canada, but also have associate members from Germany, Spain and other countries outside the region that help maintain a good relationship with development and international experiences.

1) In the case of Metrology, cooperation is coordinated through SIM. All but a few countries in the region are members of SIM. It operates working groups[36] dedicated to improving measurement capabilities in member countries. The working groups offer a good opportunity to support the development of measurement instruments and methods with the aim of increasing and monitoring the energy efficiency of products.
2) COPANT is the regional organization that promotes Standardization in close coordination with ISO and IEC. Virtually all the countries in the region are represented in COPANT. COPANT has decided to focus, in particular, on disseminating international standards in Latin America and the Caribbean, and improving the region's participation in the respective ISO and IEC forums. COPANT has put in place the CASCO Focus Group

36 Working Groups (WG) for different quantities, quality management and staff training.

dedicated to harmonizing conformity assessment procedures. The COPANT 152 TC is responsible for dealing with energy efficiency. These are working groups that should be better supported and utilized by the governments of the region.

3) FINCA provides a Forum where the IEC National Committees of the Americas can exchange experiences.
4) The IAAC represents Accreditation in Latin America and the Caribbean; that is to say, it is in charge of providing confirmation that conformity assessment bodies are working in accordance with international standards and good practices. Not all countries in the region have an NAB, and the existing NABs have not signed up to all the MRAs/MLAs. But the IAAC could be an interesting partner for the work still to be done.
5) The Quality Council of the Americas (QICA - http://qica.site/en/) is an organization that coordinates the work of the three QI organizations (SIM, COPANT, IAAC) in the Americas region.

In short, cooperation already exists between the different QI institutions at the regional (and national) level, but what are lacking are better links with the authorities that formulate energy policy and regulations, both at the national and regional levels. The existence of regional organizations offers good opportunities for better cooperation and integration of the region.

Since not all countries can have a complete QI, it is necessary to develop a framework for cooperation between the countries of Latin America and the Caribbean, for example:

- In the area of metrology, it is possible to take advantage of the established capabilities of some NMIs in terms of traceability to other countries. This applies to humidity and photometry in particular.
- In the context of testing laboratories, it is possible to use accredited, experienced and internationally recognized laboratories in neighbouring countries. This applies, for example, to Caribbean island countries or Central American countries (the ICE in Costa Rica can meet a large part of the demand within the sub-region, for example).
- The small number of accredited testing laboratories means that the necessary PTs must be organized to improve measurement and testing competencies, ensure the comparability of test results from different laboratories, and maintain accreditation at the regional level.

These activities can only be carried out in a favourable context and political framework. OLADE may be able to provide support in order to overcome certain challenges:

- Convincing the Ministries of Energy that the necessary QI funding should be included in energy efficiency policies and programs and, in particular, in labelling programs;
- Supporting the introduction of regional rules to facilitate the shipment of measurement standards and products for intercomparisons, proficiency tests and product conformity tests from one country to another (official procedures, taxes, duration, etc.);
- It would be interesting to develop a regional PT program financed by a regional fund to be determined;
- Establishing a Regional Technical Forum on Labelling Programs, perhaps bi-annually, that can serve to promote the exchange of national and international experiences with the participation of interested countries in the region and experts from Europe and other parts of the world.

5. Conclusions

1. The effective implementation of Labelling Programs requires the commitment of governments, not only to developgeneral legislatory framework but also for developing and strengthening the conditions needed to successfully implement this type of policy. One element that is lacking in many countries is a Quality Infrastructure (QI) tailored to suite the needs of each nation. This differs from country to country: While countries with developed markets and domestic production of household appliances need a fairly complex QI (NMI, NSB, NAB, testing laboratories and accredited certification bodies), small countries with limited markets and without domestic production require technical experts who know how the system functions and are able to develop and monitor labelling programs. When in doubt, these countries should be in a position to send the products to competent laboratories abroad to carry out the relevant tests (see Table 11).

Table 11

Quality Service Needs of the Different Types of Countries

	Characteristics	Countries	Needs for QI Services
1	Relatively big markets, production, exportation, and importation	Argentina, Brasil, Colombia, Mexico	Relatively complete QI services. In some cases, cooperation is necessary.
2	Limited markets, importation is prevailing, some production and exportation	Chile, Cuba, Ecuador, Guatemala, República Dominicana, Peru, Uruguay	(Public) experts know the system. Some QI services exist (for ex. standardization). Use of the services of other countries
3	Small markets, only importation	Bolivia, Paraguay, Belize, Costa Rica, El Salvador, Guyana, Honduras, Nicaragua, Panamá, Caribbean Islands	(Public) experts know the system. Some verification services. (Sub-) Regional cooperation is the main way.

Source: Prepared by Karl-Christian Goethner

2. The key issue when it comes to develop and implement labelling programs are the conformity assessment procedures (CAP) for products. Each country currently defines its own MEPS and procedures. There is very little harmonization of the procedures and documentation involved, including certificates. The application of two different types of standards, ISO/IEC standards and North American ASTM standards (often in the form of the NOM) further complicates the situation. There are a few examples of procedure harmonization, one of which is the RTCA in Central America for three products at present. COPANT has set up the CASCO Focus Group, which deals with this issue. OLADE could encourage the harmonization process by explaining its advantages in terms of time and money saved and the ability to compare product performance.

3. The lack of competent, experienced and accredited testing laboratories has a very significant effect on conformity assessment procedures. They are a necessary condition for obtaining reliable and comparable test results. One very important instrument for ensuring and improving measurement and testing methods is proficiency tests (PT), which are also required for ISO/IEC 17025 accreditation. There is a lack of (ISO/IEC 17043) accredited

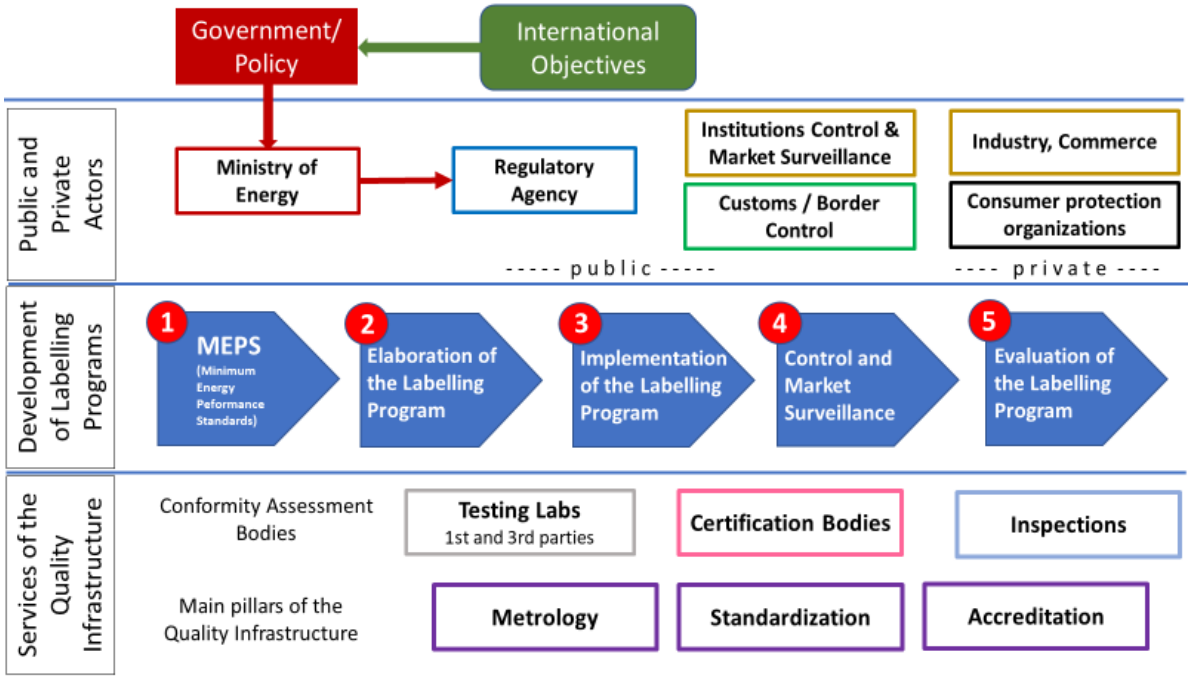
and experienced providers in the region with the necessary technical skills to organize PTs. Financing is another challenge. Since it does not make economic sense for each country to have accredited laboratories for the entire range of products, developing regional reference laboratories could be an effective and efficient solution. Promoting these lines of action could also be a task that is undertaken by OLADE.

4. Labelling programs cannot be successfully implemented without sufficiently trained and competent personnel. This applies not just to the staff of the NMI, NSB, NAB, laboratories and certifiers, but also to officials from regulatory agencies, the customs authority, control bodies and market surveillance agencies, importers, marketing companies and vendors. This is largely a task for the national authorities, but there is also a regional and international dimension that can be developed, while taking into account the regional and international experiences that should be included in national PTs.

5. Another important issue is the exchange of information and experiences with labelling programs at the regional and international level. It may be useful to implement a Regional Forum on Labelling Programs as a platform where representatives of the various stakeholder groups in the region can come together, perhaps bi-annually, to find out about the progress made and address specific issues of common interest, which can help improve labelling programs and their economic, social and environmental impacts. Forums of this type can help to bridge the communication gaps that still exist between regulators, QI institutions and other stakeholders, particularly industry and consumers.[37]

Figure 12

Actors to include in the Development of Labelling Programs



Source: Prepared by Karl-Christian Goethner

37 There have been some very positive experiences involving the organization and implementation of such forums as part of joint projects run by the PTB, OAS, SIM, COPANT and IAAC.

Parte II. Case Studies

1. The Brazilian Labelling Program (PBE)

The Brazilian Labelling Program (PBE)[38] is an energy efficiency labelling initiative coordinated by the Instituto Nacional de Metrologia, Qualidade e Tecnologia – Inmetro, in Brazil. Set up in 1984, it represents the first program of its kind in Latin America.

The program objectives are to:

a) Provide useful information capable of influencing consumers' purchasing decisions, by enabling them to consider other attributes besides price when buying products.
b) Promote industry competitiveness, by encouraging technological innovation and the development process driven by more conscious choices on the part of consumers.
c) Reduce the harmful effects of the information asymmetry existing between manufacturers and consumers.

The PBE encourages innovation and the technological evolution of products, and it functions as an instrument that promotes the production of appliances and devices that are more efficient in terms of either energy or fuel consumption. In addition to performance, the program also establishes safety requirements to minimize the possibility of consumer accidents and other criteria used to differentiate between different products on the market, such as the washing efficiency and water consumption of washing machines.

With regard specifically to energy efficiency, the PBE is aligned with Law 10,295/2011, known as the Energy Efficiency Act. Thanks to this legislation, Inmetro was able to demand better performance by appliances and devices in a mandatory fashion, based on the minimum levels of efficiency established by the Energy Efficiency Indicators and Levels Management Committee (CGIEE).

The PBE currently includes 29 sets of regulations, 22 of which are mandatory in nature, at different stages of implementation, ranging from the labelling of household appliances such as refrigerators, air conditioners, washing machines, gas cookers and gas water heaters, to more recent products from the field of renewable energies (solar water heaters and photovoltaic energy generation equipment) as well as other more complex ones with strategic energy-saving potential, such as buildings and vehicles (see Annex 1).

The PBE is part of a national system implemented to promote energy-efficient appliances and equipment, based on three different components:

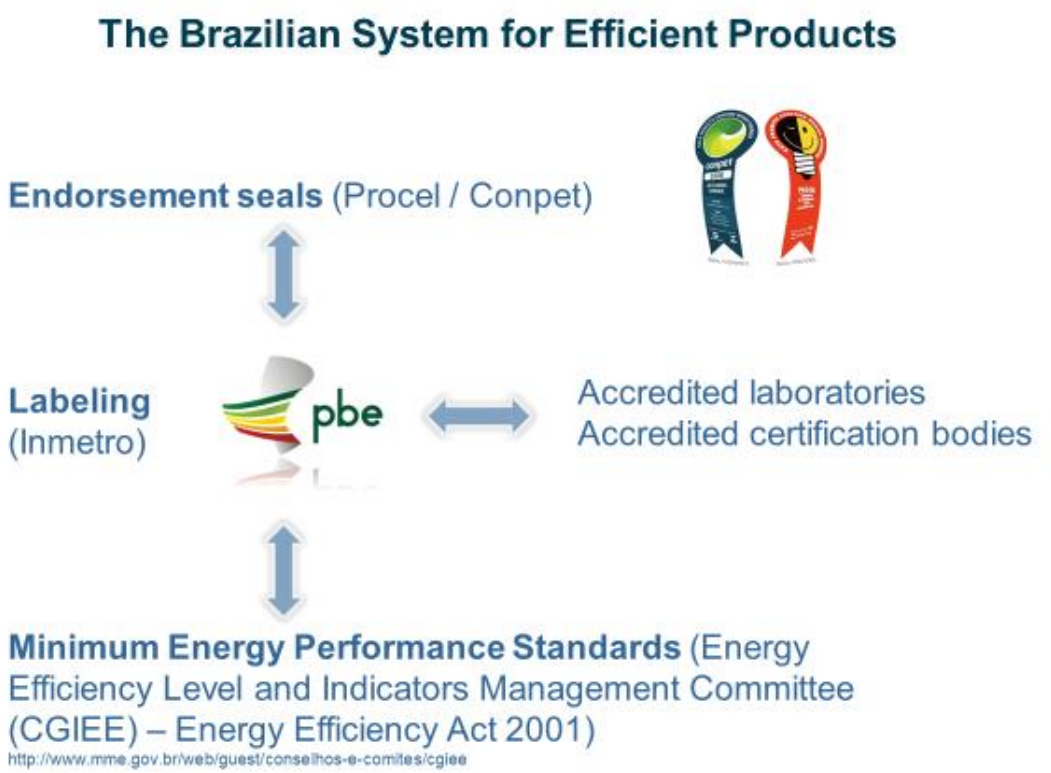
1. Minimum energy efficiency levels, of a mandatory nature, proposed by the CGIEE;
2. Energy efficiency labelling, within the scope of the PBE;
3. Energy efficiency seals, of a voluntary nature, which are quite popular in Brazil: The most efficient electrical products are given the Procel Seal, awarded by the PROCEL program. Fuel-powered ones (gas cookers, gas water heaters, and vehicles), are given the Conpet Seal, awarded by the CONPET program.

38 http://www2.inmetro.gov.br/pbe/

The three levels of regulation complement each other and together help accelerate the shift towards greater energy efficiency, innovation and competitiveness.

Figure 1

Seals for more energy-efficient products



Source: Prepared by INMETRO

The National Energy Conservation Label is a conformity seal that classifies appliances and equipment, as well as automobiles and buildings, into colour-coded categories from "A" (most efficient), usually to "E" (least efficient), and provides other relevant information such as energy or fuel consumption.

Inmetro is obliged to observe good regulatory practices in its operations in Brazil. This entails planning and executing the following steps:

Regulatory Impact Analysis (RIA)

A method that involves defining the problem for which a solution is sought, it is used to assess the risks and impact of applying different regulatory measures before coming up with a recommendation. The truth is that most regulations in the PBE have not undergone RIA, as it is a practice that has been adopted fairly recently.

Stakeholder engagement

For Inmetro, PBE coordination is one of the most critical parts of the regulatory process. The different sectors of society have interests and needs that must be harmonized. Manufacturers, importers, laboratories, certifiers, government and consumer protection bodies should be involved at every stage.

Implementation of the regulations

Following publication of the regulations, Inmetro monitors their implementation to check, for example, whether the available quality infrastructure is being strengthened as the process advances. In addition, special care must be taken when working with smaller companies and certain adjustments identified in advance need to be introduced in the regulations.

Good communication

The Brazilian experience is noteworthy in this regard, given that enormous efforts are made in the PBE to communicate with stakeholders before, during and after the publication of the regulations. Inmetro is in continuous contact with the press, with technical information being translated into a language that the public can understand. Communication is also useful for manufacturers, importers and traders, and the channels used include television, radio, social media, and press releases.

Inmetro also believes it is important to provide information about the labelled products, and consumers can consult tables containing technical data on its website.

Recent surveys show that this strategy produces results: about 72% of Brazilian consumers read the information on the label when purchasing products.

Market surveillance

Market surveillance is an obligation that regulatory authorities must fulfil and basically entails checking whether the quality tools – adopted to eliminate or minimize the problem that the regulations need to solve – really do produce the desired effect and market transformation. The main market surveillance actions implemented by Inmetro are explained in Annex 2.

Results evaluation

It is certainly important to check whether the stakeholders, especially industry, have assimilated the impacts caused by the implementation, and whether the technical regulation and its associated conformity assessment scheme is working properly. But when it comes to energy efficiency labelling, the effectiveness of a technical regulation is demonstrated by the energy savings obtained over time through operating the program.

However, this is an action that Inmetro needs to implement systematically, since only three savings evaluation studies have been carried out: for refrigerators, air conditioners and lamps. Ideally, a third party should conduct this type of assessment, thereby avoiding conflicts of interest on the part of the regulatory authority.

Lessons learned

The PBE's track record includes far more successes than failures in implementing the system to promote and encourage more energy-efficient products.

The most significant success factors have always been effective industry participation in the regulatory process, association with strong programs like Procel and Conpet, intense and frequent communication with the public, and market surveillance activities.

Challenges

The main challenges are the same ones that all energy efficiency labelling regulators face:

a. How to implement a system to periodically review energy efficiency levels and solve the problem of having only class-A products on the market?
b. How to obtain reliable market data that can be used in efficiency class reviews?
c. How to guarantee a system to periodically evaluate results so as to publish energy savings figures that can be used to improve public policies and plan the country's energy system?

Looking towards the future

The natural evolution of the PBE and other similar programs will entail the systematic advance of energy efficiency until products reach their technological limit and remain permanently in the highest class, since there will be no possibility of increasing their efficiency. The difficulty of making progress is clear in the case of some products, such as gas stoves, the next revision for which will likely see an end to the A-E classification and the adoption of a minimum level of energy efficiency.

Washing machines will also undergo significant change, as the classification will no longer consider efficiency alone and will instead be combined with three other criteria (washing efficiency, drying efficiency and water consumption).

It is reasonable to assume that the future of energy efficiency labelling programs is the evolution towards including additional criteria that might influence consumers' purchasing decisions.

Table A

Products regulated by the PBE

Programs	Mechanism	Nature
Wind turbines	Certification	Voluntary
Electric water heaters	Self-declaration	Voluntary
Gas water heaters	Certification	Mandatory
Centrifugal pumps	Self-declaration	Mandatory
Air conditioners	Self-declaration	Mandatory
Commercial, service and public buildings	Inspection	Voluntary
Residential buildings	Inspection	Voluntary
Solar water heating devices	Certification	Mandatory
Water quality improvement devices	Certification	Mandatory
Spin dryers	Certification	Mandatory
Gas cookers	Certification	Mandatory
Microwave ovens	Certification	Mandatory
Commercial Electric Ovens	Certification	Mandatory
Incandescent lamps for domestic use	Self-declaration	Mandatory
Incandescent lamps for decorative use	Self-declaration	Voluntary
Compact fluorescent lamps	Self-declaration	Mandatory
High-Pressure Sodium Vapour Lamps	Self-declaration	Mandatory
LED lamps	Certification	Mandatory
LED lamps for public lighting	Certification	Mandatory
Electromagnetic reactors for high-pressure sodium vapour and metallic vapour (halogen) lamps	Certification	Mandatory
Washing machines	Self-declaration	Mandatory
Three-phase electric motors	Self-declaration	Mandatory
Refrigerators, freezers and similar household appliances	Self-declaration	Mandatory
Systems and equipment for photovoltaic energy generation	Self-declaration	Mandatory
Televisions	Self-declaration	Mandatory
Transformers for distribution networks using insulating liquid	Self-declaration	Voluntary
Light passenger and light commercial vehicles	Self-declaration	Voluntary
Table, Standing and Air Circulator Fans	Certification	Mandatory
Ceiling fans	Self-declaration	Mandatory

Source: Prepared by INMETRO

Table B

Main market surveillance actions

Mechanism	Objective	Responsibility and Frequency	Infrastructure	Penalties
Inspection	Prevent the sale of sub-standard products	Inmetro through the Inspection Network / Every day	Institutes of Weights and Measures in each state, with teams equipped with vehicles and laptops. High cost.	Fines, confiscation of products.
Maintenance Tests	Maintain quality control	Manufacturers and importers / Usually, once a year	Accredited laboratories. There are no costs for Inmetro	Elimination of "non-compliant" products
Conformity Verification	Identify the trend in compliance achieved by programs	Inmetro / Must be more frequent for programs with a history of problems and less frequent for healthy programs	Network of inspectors. Transportation of samples taken from stores or factories. Medium cost.	They may be applied eventually, but the aim is to treat the program as a whole
Import Controls	Prevent the sale of sub-standard products	Inmetro / Daily	A team connected to the foreign trade system, for the analysis of import licenses. Medium cost	None. Imports of unlabelled products are not permitted.

Source: Prepared by INMETRO

2. The Experiences of Uruguay

In 2006, Uruguay started implementing the Efficiency Standardization and Labelling Program,[39] which provided the framework for the creation of the National Energy Efficiency Labelling System (SNE) for equipment and appliances.

This system has been implemented through decrees and resolutions issued by the Executive Administration, the legal basis for which is Law No. 18,597 on the Efficient Use of Energy of 2009.

The regulatory structure consists of a framework decree, decree 429/2009, which establishes the general characteristics of the system and individual decrees/resolutions for each appliance, which enables any particularities to be taken into account in each case, such as whether the product is produced in the country and/or whether it has the necessary testing capacity.

When appliances are incorporated into the SNE, a starting date is set, along with the duration of a first transitional or adaptation stage, which is voluntary in nature, to enable the actors involved to adapt to the regulatory requirements. Once the transitional stage has been completed, labelling of these appliances becomes mandatory.

The appliances included in the system at present are: compact fluorescent lamps, electric accumulation water heaters, electrical household refrigeration devices and air conditioners.

The main actors linked to the implementation and operation of the national labelling system are:

- The Ministry of Industry, Energy and Mining (MIEM) is the body responsible for establishing the modalities and timeframes for applying the energy efficiency labelling and monitoring it.
- The Regulatory Unit for Energy and Water Services (URSEA) is in charge of inspections, authorizing the use of the national energy efficiency label and issuing penalties.
- Actors in the National Quality Infrastructure: UNIT, as the national standardization body, the Uruguayan Accreditation Body (OAU), testing laboratories and national Product Certification Bodies (PCB) accredited by the OUA.

Main components of the SNE

National technical standards for energy efficiency

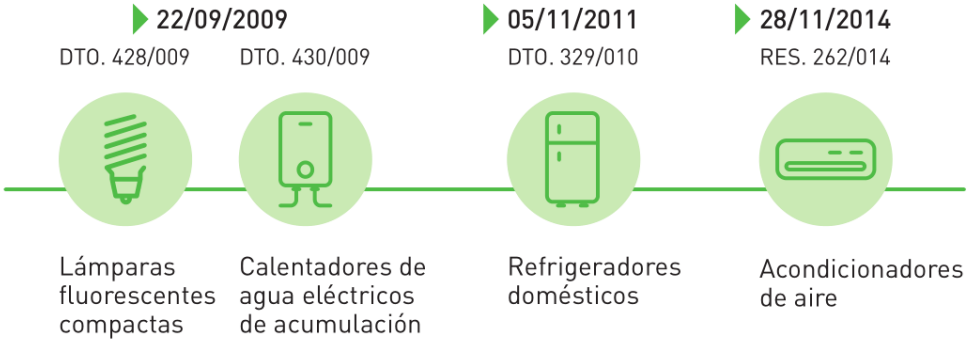
For each type of appliance, a national technical standard (UNIT) is set for the EE label, which establishes the characteristics of the label and the testing methods used, based on international standards for electrical safety and performance.

39 https://www.miem.gub.uy/energia/programa-de-normalizacion-y-etiquetado-de-eficiencia-energetica

Currently there are more than 15 national EE labelling standards in Uruguay, four of which are regulated. Figures 1 and 2 show the regulated national technical standards with their corresponding legal regulations and their main regulatory references.

Figure 1

Products with mandatory EE labelling in Uruguay, including the legal standard and date of entry into the labelling system.



Source: Prepared by MIEM

Figure 2

Technical standards currently regulated in Uruguay and their main regulatory references.

Standard	Main regulatory references
UNIT 1160 - Energy Efficiency. Compact, circular and tubular fluorescent lamps. Specifications and labelling.	IEC 60081; IEC 60901; IEC 60969
UNIT 1170 - Energy Efficiency. Air conditioners and heat pumps. Specifications and labelling.	ISO 5151; IEC 60335-1; IEC 60335-2-40
UNIT 1157 - Energy Efficiency. Electric accumulation water heaters for domestic use. Specifications and labelling.	IEC 60379; IEC 60335-1; IEC 60335-2-21
UNIT 1138 - Energy Efficiency. Household electrical refrigeration appliances. Specifications and labelling.	IEC 62552: 2007; IEC 60335-1; IEC 60335-2-24

Source: Prepared by MIEM

Conformity assessment

For all the products currently regulated, conformity assessment consists of an initial certification granted by an accredited national PCB based on a type test. It also includes:

- For fluorescent lamps and hot water tanks, monitoring every 24 months based on tests carried out on samples taken from the local market.
- For refrigerators and air conditioners, an identity check by the PCB for each lot entering the country.

Testing laboratories

The fact that the country has national laboratories allows it to respond quickly to the testing needs of national manufacturers, importers, and certification and market surveillance organizations. With this in mind, and taking into account the characteristics of the local market, the MIEM signed agreements to develop laboratories in the country for EE tests on hot water tanks and lamps.

The following table summarizes the local testing capacity.

	Hot water tanks	**Refrigerators**	**Lamps**
Testing laboratories	UTE, LATU, IADEV	IADEV	UDELAR

There is no testing capacity for air conditioners in the country and the lamp laboratory at the University of the Republic (UDELAR) is not yet accredited, so the testing needs for lamps and air conditioners are met using the regional testing capacity, particularly that of Argentina.

Market control and surveillance

The Energy and Water Services Regulatory Unit (URSEA) is the body responsible for SNE market surveillance, with particular emphasis on the following tasks:

1) Authorization to use an energy efficiency label:

Once a product enters the mandatory labelling stage, it must have authorization to use the energy efficiency label issued by URSEA in order to be brought into and sold in the country. The request for authorization to use the label is an online procedure carried out by the manufacturer or importer of the product and to obtain it, it is necessary to submit the certificate of conformity issued by a PCB.

2) Trade inspection

It is carried out by URSEA personnel and its objectives include:

- Verifying the presence and visibility of the label on regulated products.
- Informing businesses about technical and legal regulations.

These inspections have been conducted since 2014 in such a way as to cover the 19 departments of the country every two years and 100% of the population centres with over 10,000 inhabitants every three years. Between May 2014 and July 2017, more than 353 businesses were inspected, with violations found in 150 of them.

3) Oversight tests

The oversight tests conducted by URSEA are independent of the actions of the PCBs. To determine whether or not a model complies with regulations, up to three samples of the same model must be tested.

4) Issuance of penalties

The URSEA has established procedures for verifying compliance with the regulations, as well as the criteria that are applied to determine the penalties for any violations found. The information is available on the URSEA website.

5) Border control

In order to import equipment and appliances covered by the system, it is necessary to have an authorization to use the labels issued by URSEA. URSEA is in continuous communication with the customs authority, through a computerized system that synchronizes the database of authorized products on a daily basis.

Currently, there is no justification for URSEA personnel to carry out border inspections. Smuggling can be detected through inspections in shops. The presence that URSEA maintains in the market is such that the amount of smuggling of products in the system can be assumed to be negligible.

Special features of the SNE

The national labelling system is equipped with three particularly useful policy tools:

1. Database of authorized products: The URSEA publishes up-to-date technical information about all labelled appliances on its website.
2. Sales tracking: Manufacturers and importers are required to inform the MIEM, confidentially every six months, of the quantity of each labelled appliance that is sold on the local market, broken down by brand, model and energy efficiency class.
3. Funding of activities: The national energy efficiency law provides mechanisms for certifying, promoting and financing the efficient use of energy. In particular, it established the creation of the Uruguayan Energy Savings and Efficiency Trust (FUDAEE), managed by MIEM, which provides an annual budget to fund activities involving:
    - Research and development on energy efficiency and renewable energy promotion.
    - Cultural change, education, promotion and information dissemination campaigns on energy efficiency aimed at all energy users.
    - Control and monitoring of the energy efficiency labelling of appliances at the national level.
    - Retrofitting and equipping of national laboratories to ensure the necessary testing capabilities to promote and develop energy efficiency in the country.

The product database facilitates market surveillance tasks, while sales tracking facilitates impact assessment and the continuous improvement of labelling policies.

Monitoring and evaluation of results

MIEM carries out six-monthly monitoring of sales on the market by model and energy efficiency class of the labelled appliances. Figures 3 to 5 in the Annex show the market penetration of efficient appliances.

Based on this information, methodologies are being developed to determine the reduction in energy consumption due to the incorporation of more efficient appliances. The aim is to publish the savings estimation methodology to be applied in each case, as well as the results obtained, during the course of 2019. According to preliminary estimates, as a result of labelling on compact fluorescent lamps, electric heaters and refrigerators and freezers, in 2016 electricity demand in the residential sector was 5% lower than expected based on current trends. Figure 6 in the Annex shows the evolution of the real demand for electricity in the residential sector and the expected demand if the labelling had not been implemented.

Lessons learned

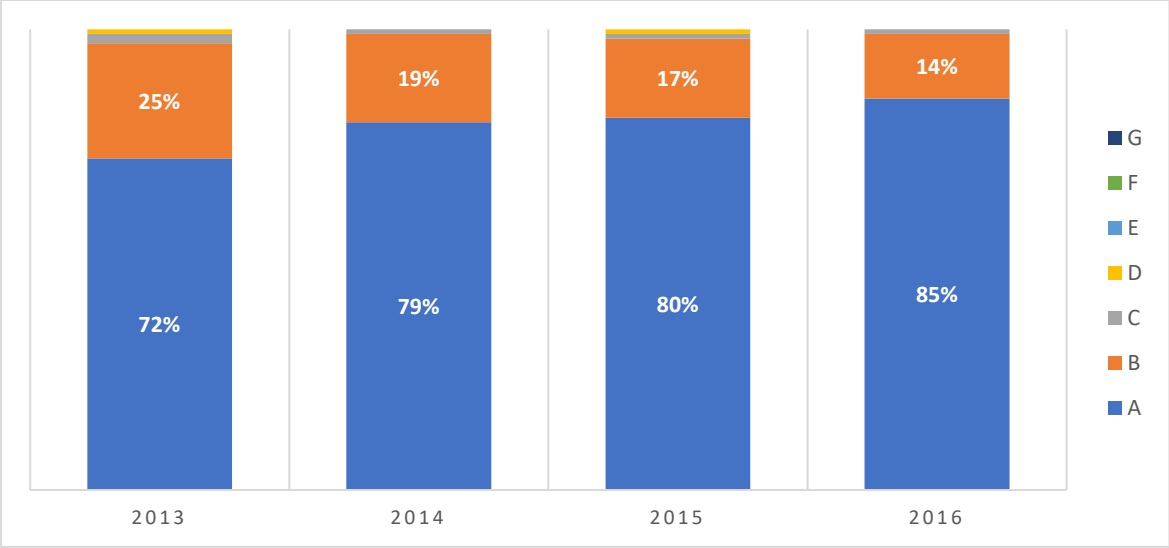
1) It is essential that public and private actors are involved in the regulatory process.
2) The obligation to label appliances that are included in the system contributes towards the development of a market in which the rules associated with the quality and performance of energy-consuming products are clearly defined.
3) The creation of an up-to-date and universally accessible database on all the authorized products on the market, and the obligation for importers and distributors to provide sales information for monitoring and evaluation, are key instruments for carrying out system tracking, generating indicators and providing projections for the energy savings goal.
4) It is necessary to accompany labelling with information, dissemination and awareness campaigns aimed at different sectors of society in order to promote cultural change.

Future challenges

1) Evaluating improvements to conformity assessment schemes and the need to strengthen local testing capacity.
2) Reducing shipping times for samples sent for testing at laboratories abroad.
3) Incorporating new equipment: LEDs, light vehicles, gas appliances and engines.
4) Updating technical standards already in place and updating labels.
5) Developing tools and applications to facilitate user access to clear and simple information on appliances and enable energy performance to be incorporated as another factor to be considered when making purchasing decisions.
6) Implementing complementary policies in addition to labelling to promote efficient appliances.

Figure 3

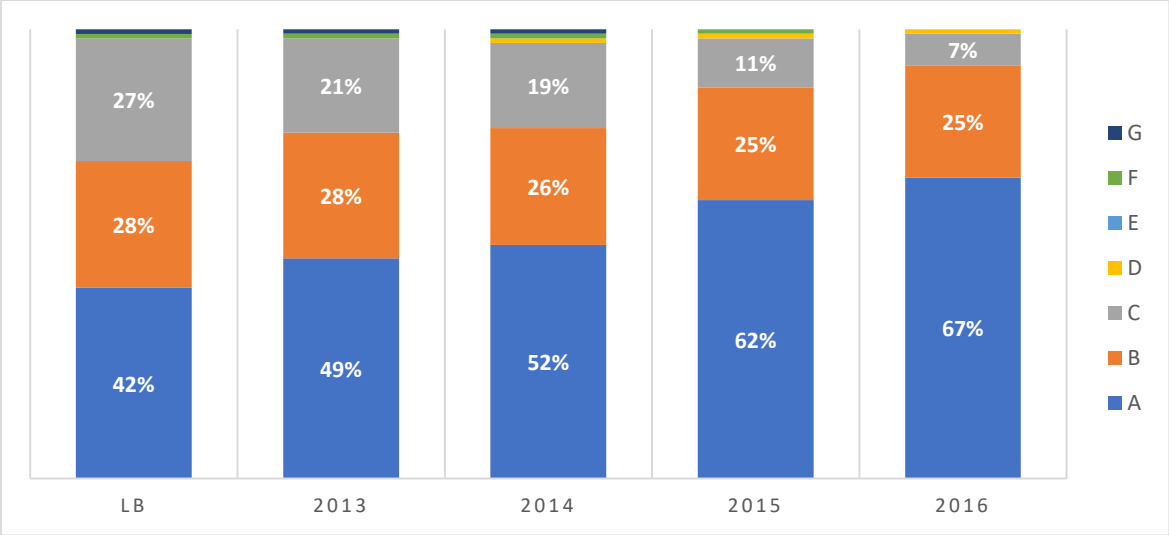
Sales of electric water heaters by energy efficiency class. 2013 – 2016



Source: Prepared by MIEM

Figure 4

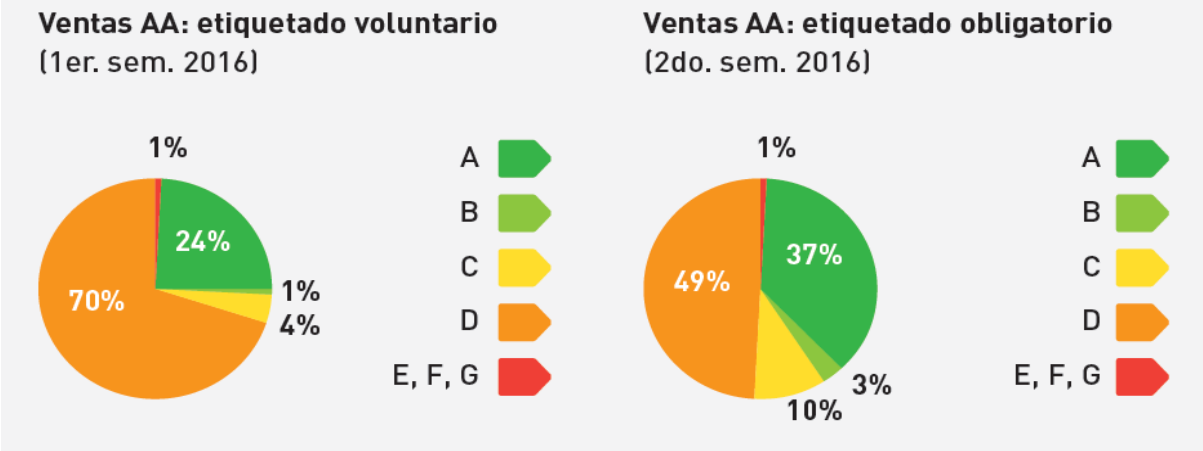
Sales of refrigerators and freezers by energy efficiency class. 2013 – 2016



Source: Prepared by MIEM

Figure 5

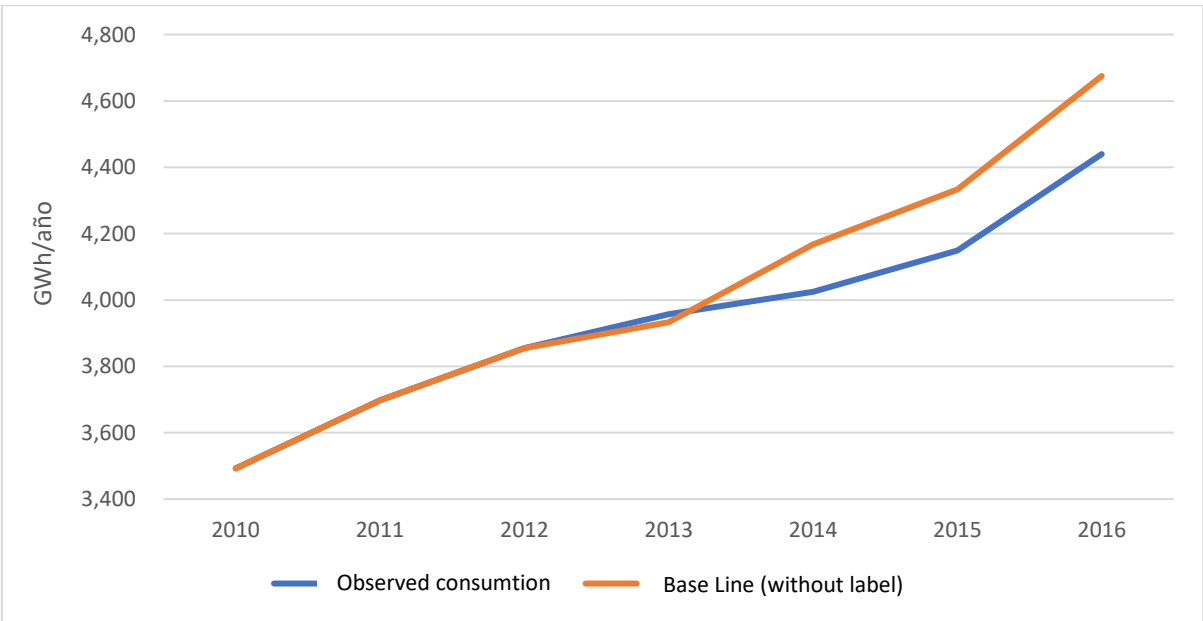
Sales of air conditioners by energy efficiency class.



Source: Prepared by MIEM

Figure 6

Real vs. expected residential sector electricity demand. Evolution 2010 – 2016.



Source: Prepared by MIEM

3. Quick Response Code (QRCode): The Experiences of Chile

In Chile, the mission of the Superintendency of Electricity and Fuels (SEC) is to ensure that consumers have access to safe and quality products and services within the electrical, gas and fuel systems.

Its main product-related functions are to establish technical regulations, oversee and mobilize markets to ensure that the electrical and fuel-consuming products sold in the country, which are regulated by the SEC, have the required certification.

The product certification is mainly based on the Product Certification Regulation, DS N° 298, of 2005. This regulation contains:

- A description of the certification systems, which is based on the ISO/CASCO certification models;
- The responsibilities of companies;
- Objectives and sanctions;
- The requirements for the recognition of foreign certificates.

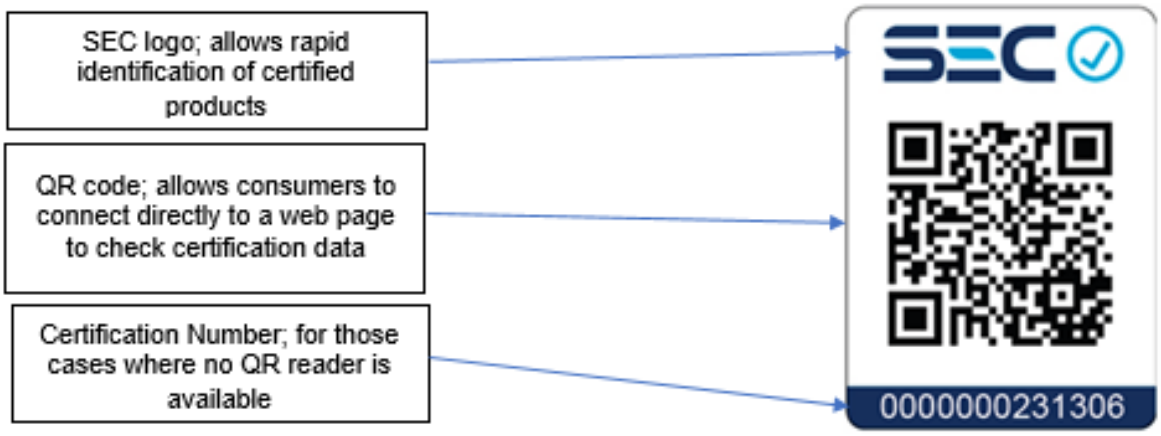
DS 298 also states:

- That products should be certified before entering the market.
- That certification bodies and testing laboratories must be authorized by the SEC.
- That the end seller is responsible for providing customers and end consumers with the energy efficiency and safety mark, as well as the certificate of approval for the product.

These rules also apply to electronic commerce.

Figure 1

Features and benefits of the QR Seal



Source: Prepared by SEC

Chile was one of the first countries in the world to introduce a QR code. This mark was implemented in 2012 and enables consumers to:

- Rapidly identify certified products.
- Access product information using an app with a QR reader.

The benefits of the QR code can be summarized as follows:

(a) For consumers:

- It enables access to useful information about the product that helps with purchasing decisions.
- Given the widespread use of smartphones, the information is obtained as soon as the QR code is scanned in the store.
- Since it is the only compliance mark, there is no confusion on the part of the end user about which products are certified.
- One-step access to information. By scanning the QR code, the user can immediately obtain key information about the product certification without needing to enter additional information such as website address, product type, brand and model.
- It encourages further involvement in product safety programs by offering an easy tool for providing feedback to decision makers and other stakeholders.
- Since it replaces the paper approval certificate, the SEC seal helps to preserve the environment by eliminating paper printouts.

(b) For market surveillance officials:

- It enables easier access to the certification database.
- It enables easier access to terminology supporting day-to-day work.
- It provides greater feedback from users, when they find non-certified products or when the information does not correspond to the product (misused seals)

(c) For distributors and vendors:

- They can refer to the information in the QR Code when they are trying to convince consumers to purchase certified products.

(d) For decision makers it is a great achievement because:

- It helps prevent non-compliance through mass dissemination of market monitoring results.
- It is a modern method for managing programs.

The main benefits of a QR Code are the following:

- A single seal of compliance.
- Instant access to certification information.

The challenges for perfecting the QR Code in the future include in particular:

1) Adding more information, such as latest batches approved.
2) The possibility of adding energy efficiency data.

Experiences with the introduction of the QR Code in Chile

- The implementation of the SEC seal has eliminated the confusion regarding conformity marks. Having a single seal means there is no possibility of confusion.
- The SEC mark has become more widely known and users can recognize certified products as soon as they see the SEC seal.
- The certification database system was already in place when the SEC seal was implemented, so this new system uses the established platform to present information to the user.
- The SEC seal has also been extended to online sales so that users can check certified products.

Table C

The information contained in the QR Code in Chile

Source: Prepared by SEC

As shown in the image, the information displayed when scanning the SEC seal is the following:

(1) Certification Data / Sale Authorizations;
   a) SEC sheet
   b) Certificate No.
   c) Certificate Date
   d) Issuing Agency

(2) Product Data
   e) Product
   f) Brands
   g) Models
   h) Country of manufacture

Part III. Quality Infrastructure for Labelling Programmes: A guide

Introduction

The services of the Quality Infrastructure (QI) are an essential element in the development, execution and monitoring of labelling programs. Including QI institutions as one of the most important program stakeholders from the initial preparation stage up to the monitoring and impact measurement proves to be essential to their successful implementation. The QI is a highly complex and expensive system and it does not make sense, therefore, to develop a complete QI for each country in the region, which differ in terms of:

1. market size
2. the existence and amount of production and export of electrical products
3. the level of imports of such products.

In Latin America and the Caribbean, it is possible to identify three broad groups that have different needs with respect to quality services, as shown in the table below.

Table 1

Quality Service Needs of the Different Types of Countries

	Characteristics	Countries	Needs for QI Services
1	Relatively big markets, production, exportation, and importation	Argentina, Brasil, Colombia, Mexico	Relatively complete QI services. In some cases, cooperation is necessary.
2	Limited markets, importation is prevailing, some production and exportation	Chile, Cuba, Ecuador, Guatemala, República Dominicana, Peru, Uruguay	(Public) experts know the system. Some QI services exist (for ex. standardization). Use of the services of other countries
3	Small markets, only importation	Bolivia, Paraguay, Belize, Costa Rica, El Salvador, Guyana, Honduras, Nicaragua, Panamá, Caribbean Islands	(Public) experts know the system. Some verification services. (Sub-) Regional cooperation is the main way.

Source: Prepared by Karl-Christian Goethner

The typology clarifies that only countries with large markets and significant manufacturing of electrical products require extensive quality services, but even they have to make use of services from other countries. On the other hand, limited markets that only import products depend on cooperation with services abroad but need experts who have an in-depth knowledge of standards, good practices and the quality of foreign services. Only in this way it is possible to ensure that the products released onto the market meet the energy efficiency requirements set by the labelling programs.

The checklist should serve as a guide for the entities in charge, to assist them in answering the following questions:

1. For which activities is it necessary to include QI institutions?
2. Which quality services are needed to develop, implement and monitor labelling programs?
3. What QI development needs arise as a result of labelling programs?
4. What needs to be developed in the country and when is it better to seek coordination and cooperation with other countries?

Table 2

Check list

Step	Activity	Sub-activity/Aim	Entity in charge	QI bodies
Preparation phase				
1.	Elaboration of MEPS	Study international documents and guidelines What is the State of the Art?	National Energy Council Energy Ministry Regulatory Agency	QI experts (NSB, NMI, NAB)
		Country analysis and outlook What is needed now and in the coming years?	Energy Ministry Finance Ministry	
		Definition of MEPS Which MEPS are necessary and achievable within a given time period?	Energy Ministry Regulatory Agency	NSB
2.	Risk Assessment, Regulatory Impact Assessment (RIA)	Evaluation of economic, social, environmental impacts, etc.	Regulatory Agency	NSB
		Analysis of electrical products produced/imported and evaluation of demand for tests/checks (Market research) What groups of products are produced/imported (per year) and in what volume? What is the current situation and what is expected in the medium (3 to 5 years) and long term (10 years)?	Regulatory Agency in cooperation with Energy Ministry Finance Ministry	
		Definition of priority products for labelling programs What are the most important products due to their volume and their influence in reducing energy consumption?	Regulatory Agency	
3.	Ecosystem Study	Identification of stakeholders according to the specific situation of each country Which stakeholders present in the country should be included in the process?	Regulatory agency in cooperation with: Energy Ministry Finance Ministry	
		Studies on the standards in force (international, regional, national) What is already in place and what gaps need to be filled?	Regulatory Agency	NSB

Review CAPs within and outside the region What CAPs are applied in LAC and in other regions? How worthwhile is to apply these CAPs (perhaps in an adapted manner) in the country? Is there any possibility of cooperation and coordination with neighbouring countries?	Regulatory Agency Energy Ministry Finance Ministry	NMI NSB NAB
Analysis of the technical competencies of the NMI and the existing measurement traceability What peer review recognized labs are there, where are there gaps and how can they be filled? What is economically feasible? For which products is it better to take advantage of capabilities abroad (preferably, but not only, in the region)?	Regulatory Agency	NMI
Analysis of the technical competences of the existing testing laboratories (1st and 3rd party) What are their current technical capabilities and competences? What is needed for the future? What are the shortcomings and how can they be overcome? What is economically feasible? For which products is it better to take advantage of capabilities abroad (preferably, but not only, in the region)?	Regulatory Agency	NMI NAB Testing laboratories
Analysis of the certification bodies working in the country What are their current technical capabilities and competences? What is needed for the future? What are the shortcomings and how can they be overcome? What is economically feasible? For which products is it better to take advantage of capabilities abroad (preferably, but not only, in the region)?	Regulatory Agency	NAB
Analysis of the competencies of border control and market surveillance institutions What institutions exist, which should be developed and how should skills be improved?	Energy Ministry Regulatory Agency	NSB NAB
Analysis of regional and international experiences and good practices Which ones exist and how can they be best used in the country?	Regulatory Agency	NSB NMI NAB

Development phase				
4.	Preparation of the Labelling Program	Review of current international standards What are the standards to be applied? Which ones should be transformed into national standards? How can it be ensured that they are continually updated? How can additional Technical Barriers be avoided?	Regulatory Agency	NSB
		Determination of the label content and design Which of the existing models is most suited to the needs of the country? What information is provided on the label?	Regulatory Agency	NSB NMI NAB
		Ensuring the measurement traceability What quantities need to be developed or strengthened in the country's NMI? For which quantities is traceability provided to NMIs in other countries?	Energy Ministry Finance Ministry	NMI
		Development of a program to strengthen CABs (testing laboratories, certification bodies, inspection bodies) What CABs need to be strengthened in the country based on market size? What are their instruments and activities? In which areas is it necessary to develop contacts with CABs in other countries to ensure the success of the program?	Energy Ministry Finance Ministry	NMI NAB
		Development of a market surveillance and control system Which institutions are in charge? Which are the implementing agencies? What instruments do they wish to use? What quality services are required? What human resources already exist? What human resources need to be trained and developed?	Regulatory Agency Energy Ministry Finance Ministry Market surveillance and control authorities	NMI NSB NAB
		Development of a monitoring system What are the monitoring tasks? Who are the stakeholder representatives on a monitoring committee? What is the meeting schedule?	Regulatory Agency	NMI NSB NAB Testing laboratories Certifiers
		Set up of an impact measurement system What are the indicators? What is the baseline and how will it be established? How is the data collected, compiled and published? Which QI institutions are involved?	Regulatory Agency Energy Ministry Market surveillance and control authorities	NMI NSB NAB Testing laboratories Certifiers
		Set the transition period How long do industry, commerce, QI and market surveillance and control authorities need to fully meet their obligations?	Regulatory Agency Energy Ministry Finance Ministry Market surveillance and control authorities	NMI NSB NAB Testing laboratories
		Search for opportunities for international cooperation	Regulatory Agency	NMI

		With which countries / regional and international organizations is it necessary to establish contacts and to develop cooperation agreements? What are the legal and logistical issues that need to be resolved in this case (customs, foreign trade regulations, etc.)?	Energy Ministry Finance Ministry Foreign Ministry	NSB NAB
		Development of a continuous training system for the personnel of the institutions involved What are the institutions involved (ministries, customs authority, municipalities, etc.) and which groups of people should be trained in which areas?	Regulatory Agency	NMI NSB NAB
Implementation phase				
5.	Implement the program	Program kick-off workshop to draw up an action plan with stakeholders	Regulatory Agency Energy Ministry	NMI NSB NAB
		Implement the activities planned	Regulatory Agency	NMI NSB NAB CAB
		To sign and implement bi-/multilateral agreements on using quality services from other countries (temporary export and import agreements, etc.)	Regulatory Agency Energy Ministry Finance Ministry	NMI NSB NAB
		Implement possibilities of mutual recognition of product certificates (in accordance with CASCO / ISO / IEC 17067 models)	Regulatory Agency Energy Ministry Finance Ministry	Testing laboratories Certifiers
Monitoring, Adjustment and Impact Measurement Phase				
6.	Monitoring	Review of program performance, verification of the progress, identification of gaps and challenges, and – if necessary – adjustment of the program and action plan	Regulatory Agency with all stakeholders	NMI NSB NAB CAB
7.	Impact measurement	Collection of the relevant data as defined in the impact measurement system	Regulatory Agency	NMI NSB NAB CAB

INM - Instituto Nacional de Metrología
ONA - Organismo Nacional de Acreditación
ONN - Organismo Nacional de Normalización

Source: Prepared by Karl-Christian Goethner

Part IV. Appendices

1. The Institutional Framework for Energy Efficiency in Latin America and the Caribbean (2018)

Energy Efficiency Laws	Brazil, Colombia, Costa Rica, Chile, Ecuador, El Salvador, Honduras (UP), Mexico, Nicaragua, Panama, Peru, Uruguay, Venezuela
National and local Energy Efficiency agencies	Bolivia (UU), Brazil (UU), Colombia (UU), Costa Rica, Cuba (UU) Chile, El Salvador (UU), Guatemala (UU), Honduras (UU), Jamaica (UU), Mexico, Nicaragua (UU), Panama (UU), Paraguay, Peru (UU), Uruguay, Venezuela (UU)
NEEAP	Bolivia, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, Honduras, Mexico, Panama, Paraguay, Peru, Uruguay, Venezuela

Key: UP - Under preparation

UU – Under update

Source: ECLAC/OLADE/IDB

2. Labelling programs and MEPS in Latin America and the Caribbean

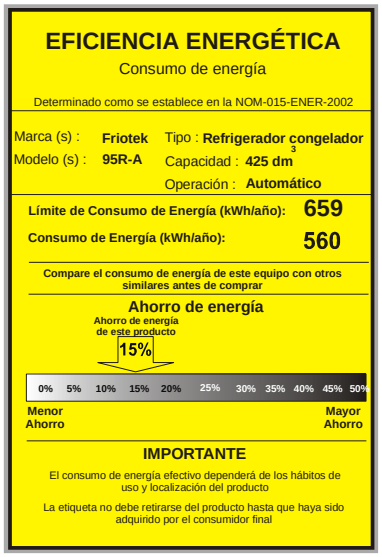
Country	**MEPS**	**Labelling programs**				
	Household appliances (*)	**Lighting**	**Fridges**	**Air conditioners**	**Lighting**	**Other**
Argentina	X	X	X	X	X	X
Bolivia			X (**)			
Brazil			X	X	X	X
Chile			X	X	X	X
Colombia			X	X	X	X
Costa Rica			X	X	X	X
Cuba (**)			X	X	X	
Ecuador			X			X
El Salvador	X					
Grenada (**)			X	X	X	X
Haiti (**)	X					
Jamaica						
Mexico	X	X	X	X	X	X
Nicaragua			X	X		X
Panama	X		X			
Paraguay			X			
Peru	X (**)		X	X		X
Uruguay			X	X	X	X
Venezuela			X	X	X	

(*) Includes air conditioning

(**) Under preparation

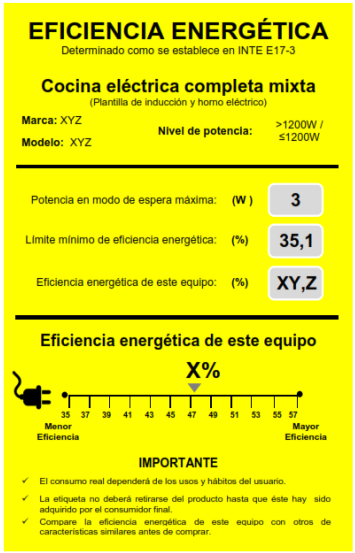
Source: Prepared by the author based on OLADE 2017, pp. 96-97 and information received from the countries

3. Labels in Latin America and the Caribbean

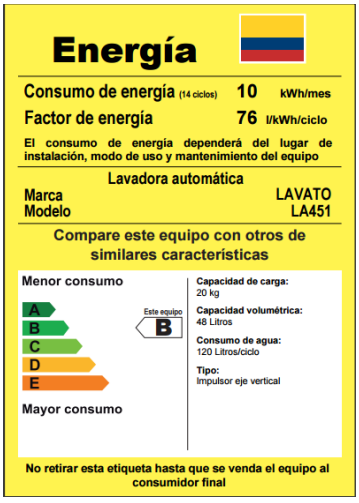


Mexico

El Salvador

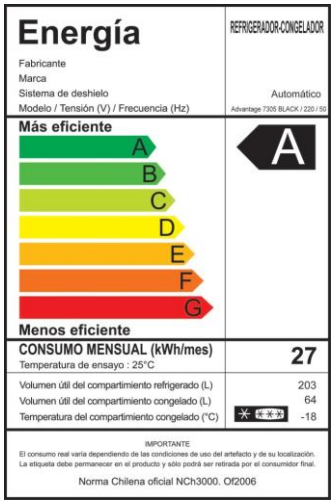


Costa Rica

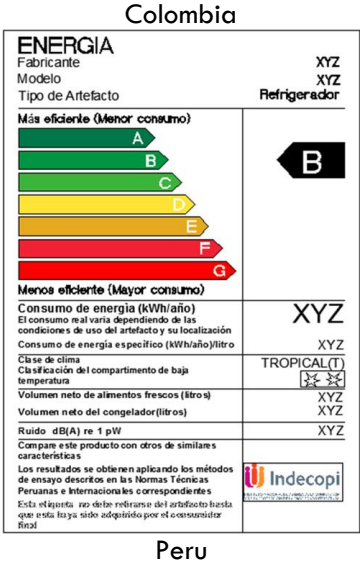


Colombia

Brazil



Chile

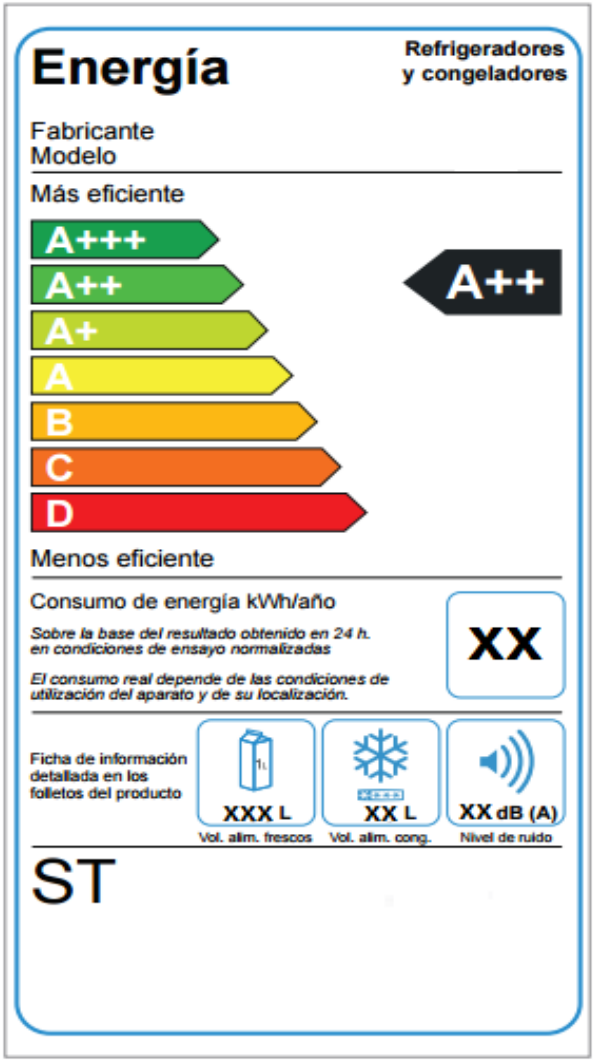


Peru

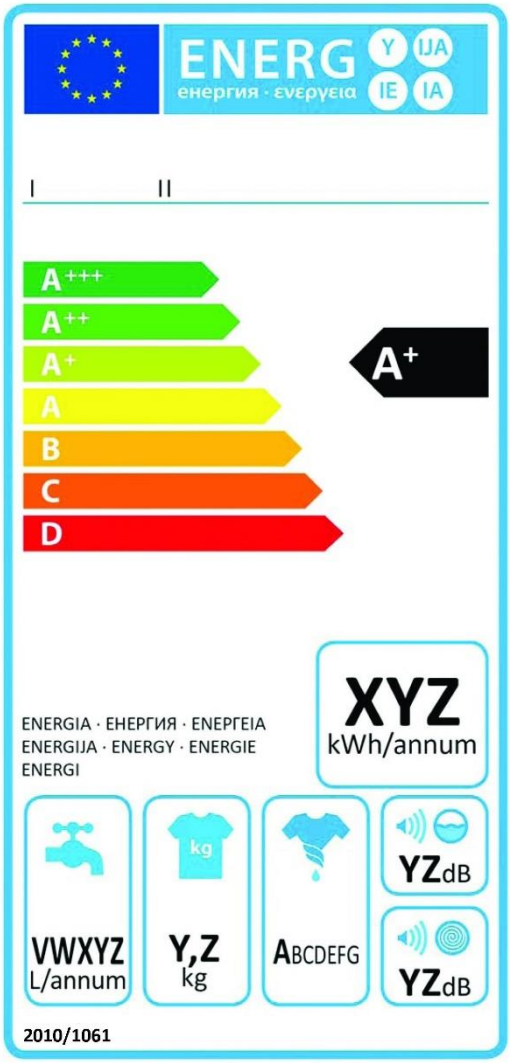
Argentina

Uruguay

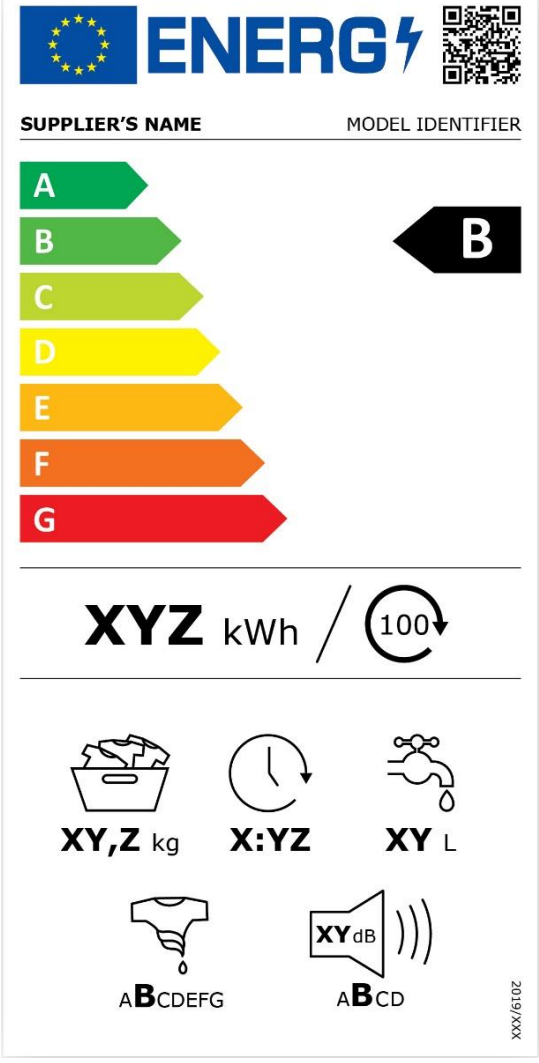
COPANT TC 152 Recommendation



4. Old and new Ecolabels in Europa



Old Version



New version

The old ecolabel design will be used until 2021 when the new ecolabel will enter in force. The transition perio will be supported by a communication campaign.

5. Signatory countries of the MLA / IAAC

Country	NAB	QM Systems (ISO 17021)	Calibration lab. (ISO 17025)	Testing lab. (ISO 17025)	PT providers (ISO 17043)	Product certification body (ISO 17065)	Inspection body (ISO 17020)
Argentina	OAA	X	X	X	X	X	X
Brazil	INMETRO	X	X	X	X	X	X
Chile	INN	X	X	X	---	X	X
Colombia	ONAC	X	X	X	---	X	---
Costa Rica	ECA	X	X	---	---	X	X
Cuba	ONARC	---	X	X	---	---	X
Ecuador	SAE	X	X	X	---	---	X
El Salvador	OSA	---	X	X	---	---	---
Guatemala	OGA	---	X	X	---	---	X
Jamaica	JANAAC	---	---	X	---	---	---
Mexico	Ema	X	X	X	X	X	X
Nicaragua	ONA	---	X	X	---	---	X
Paraguay	ONA	---	---	X	---	X	X
Peru	INACAL-DA	X	X	X	---	X	X
Uruguay	OAU	X	X	X	---	X	---

Source: http://www.iaac.org.mx/English/MembersListMLASignatories.php

6. Accredited laboratorios for energy efficiency testing of household appliances in Latin American and the Caribbean (Selected)

Country	No. of accredited labs (1)	Product categories			PT providers
		Fridge	Lighting	Other	
Argentina	9	3	5	3	0
Bolivia	0	0	1 (2)	0	0
Brazil	30				2
Colombia	6				0
Costa Rica	1 + 1 (3)	1	1	1	0
Chile	8	3	2	5	0
Ecuador	2	2	1	0	0
Guatemala	1 (3)	1	0	0	0
Mexico	15 + 5 (3)				2
Paraguay	0	0	2 (2)	0	0
Uruguay	3	1	0	2	0

(1) A laboratory can be accredited for various product categories

(2) Accreditation process underway

(3) In-house laboratory (1st party)

Source: Own elaboration

7. COPANT's Energy efficency standardization work

The COPANT TC 152 Technical Committee develops harmonized technical standards for energy efficiency and renewable energy by adapting ISO/IEC standards to the climatic conditions of Latin America and the Caribbean.

The TC has 32 full members and ten associate members (including DIN, AFNOR and UNE). Application of the standards is not mandatory.

As of the end of 2018, 16 technical standards had been published:

COPANT 1707:2014	Energy efficiency. Refrigerators, freezers and combined fridge-freezers for household use. Specifications and labelling.
COPANT 1708:2006	Energy efficiency. Incandescent lamps for domestic use and the like. Specifications and labelling
COPANT 1711:2014	Energy efficiency. Air conditioners. Specifications and labelling.
COPANT 1712:2014	Energy efficiency. Household washing machines. Specifications and labelling.
COPANT 1713:2014	Energy efficiency. Electric accumulation water heaters for domestic use. Specifications and labelling.
COPANT 1714:2014	Energy efficiency. Centrifugal pumps. Specifications and labelling.
COPANT 1715:2015	Energy efficiency. Fixed electric instantaneous water heating devices. Specifications and labelling.
COPANT 1716:2015	Energy efficiency. Accumulation gas water heaters. Specifications and labelling.
COPANT 1717:2015	Energy efficiency. Gas cooking appliances. Specifications and labelling.
COPANT 1718:2015	COPANT 1718 Energy efficiency. Gas instantaneous water heaters. Specifications and labelling.
COPANT 1719:2016	Energy efficiency. Compact, circular and tubular fluorescent lamps. Specifications and labelling.
COPANT 1720:2016	Energy efficiency. Three-phase induction electric motors. Efficiency class (IE) and labelling.
COPANT 1721:2016	Energy efficiency. Ballasts for discharge lamps. Specifications and marks.
COPANT 1722:2016	Energy efficiency. Performance of household and electronic appliances. Methods for measuring standby power.
COPANT 1723:2016	Energy efficiency. Gas room heaters. Specifications and labelling.
COPANT 1725:2017	Energy efficiency. Gas boilers for heating and other additional uses with a maximum nominal power of 75 kW. Specifications and labelling.

Source: Pablo Paisán, IRAM (Argentina)

8. Estimated energy losses due to non-compliance with technical regulations

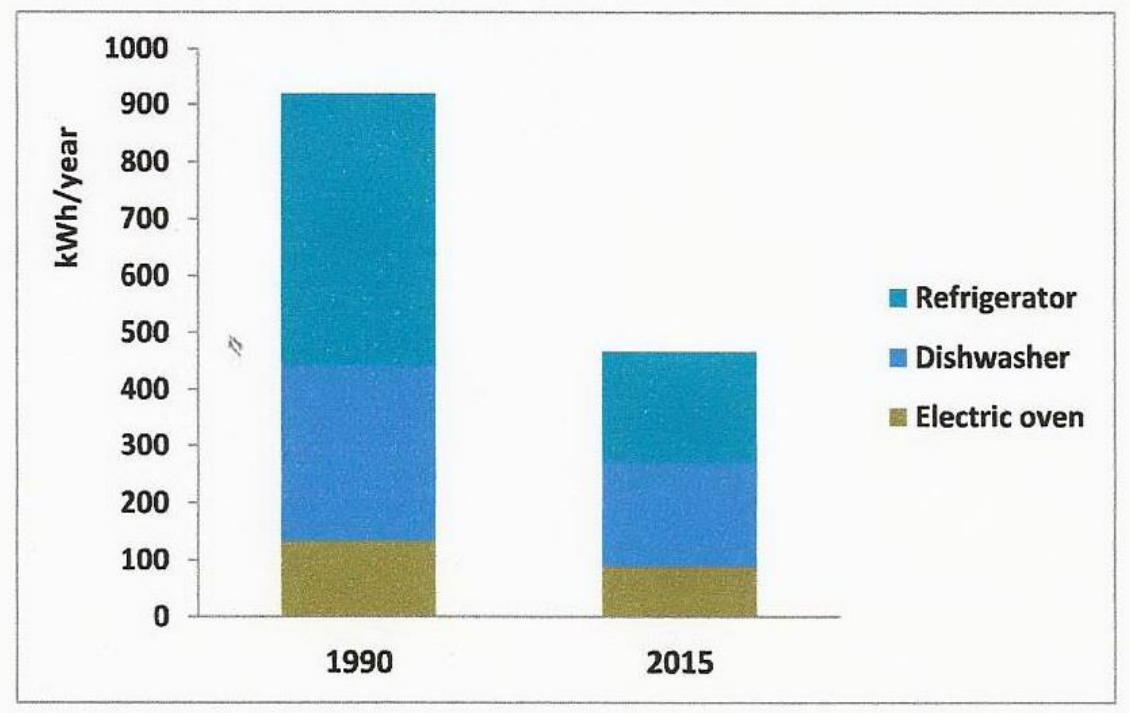
Estimates of level of non-compliance and energy lost

Non-compliance rate	Note	Source
25 – 50%	Global estimate of non-compliant products	Ellis, 2012
10 – 20%	Ecodesign related non-compliant products	CSES, 2012
10%	Value of energy lost, global	Waide, et.al., 2011
15%	Label and ecodesign non-compliant products	Defra, 2009
25%	Non-compliant products concerning missing label declarations at sales points	Defra, 2009
21% 54%	Refrigerators, products non-compliant, - energy class declaration - some requirement	ATLETE, 2011
33 – 38% 11-14%	Products offered for sale without label display Products with partial or incorrect label display	Come On Labels, 2013 b
0 – 60%	Denmark, non-compliant products based on tests of various product groups.	DEA, 2012; Atlete, 2011; Atlete II, 2013b
20 – 73%	UK, non-compliant products based on tests of various product groups	IEA, 2010; Atlete, 2011; Culling, 2010; Waide et.al., 201; CLASP, 2010

Source: Prepared by Juraj Krivošik

9. Impacts

9.1 Energy consumption for three products (under standardized conditions) on the EU market between 1990 and 2015



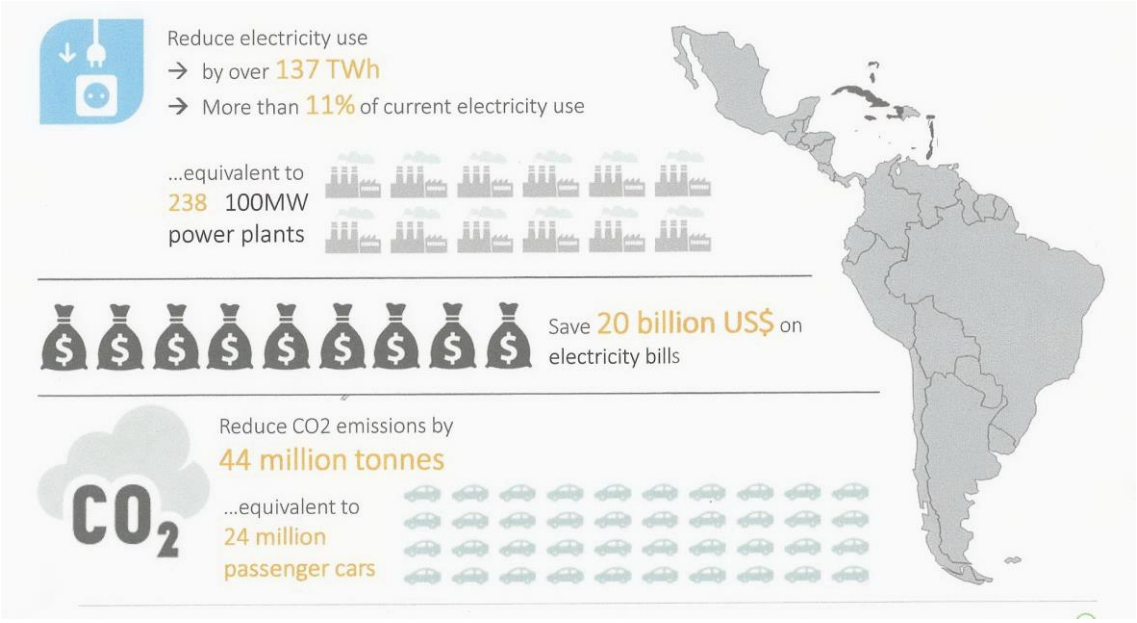
Source: eceee (2018). Energy sufficiency in products. Concept paper, p.10

9.2 India: Labelling programs for nine product categories have a savings of 5954 GWh, which prevents a generating capacity of 4847 MW and the emission of 6 million tonnes of greenhouse gases (2012)

Sr.no.	Name of the Product	Annual Productions/sales (2012)	Savings in MWh (2012)	Avoided Capacity (MW)	GHG Reduction (million tonnes CO2)
1	Direct Cool Refrigerators	75,86,935	26,41,604	529	2.46
2	Frost Free Refrigerators	26,73,786	9,73,314	195	0.91
3	Room Air Conditioners	27,01,390	12,81,183	1,872	1.19
4	Tubular Fluorescent Lamps (36 Watts)	12,54,96,044	6,02,381	880	0.56
5	Color Television Sets	9,75,104	16,532	4	0.02
6	Ceiling Fans	9,03,815	41,995	20	0.04
7	Geysers	11,62,163	1,85,264	1,300	0.17
8	Distribution Transformers	2,64,584	2,10,996	32	0.20
9	Pumps (openwell, monoset & Submersible)	783	803	15	
10	Total	14,17,64,604	59,54,072	4,847	6

Source: Carreño (CLASP 2017)

9.3 Potential annual savings for Latin America and the Caribbean due to the transition to more energy-efficient refrigerators by 2030



Source: Carreño, CLASP, 2017

9.4 Impact assessment: Mexico case study

Impact of technical standards implemented between 1995 and 2004, evaluated for 4 product categories

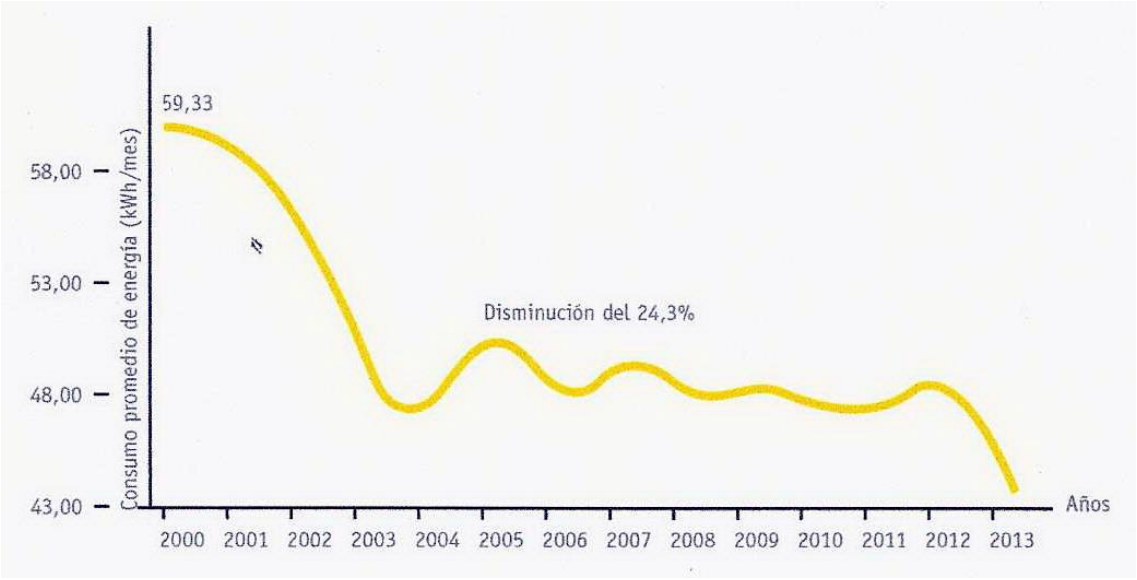
The technical standards have reduced the energy consumption by **46 TWh** and avoided CO2 emissions of **30 Gt** between 1995 and 2004

In 2005, the energy demand has reduced by 9.6%

The impacts were 25% higher than originally estimated

Source: Carreño, CLASP, 2017

9.5 Brazil: Evolution of the average consumption of refrigerators with PROCEL seal in Brazil



Source: IDB 2015, p. 23

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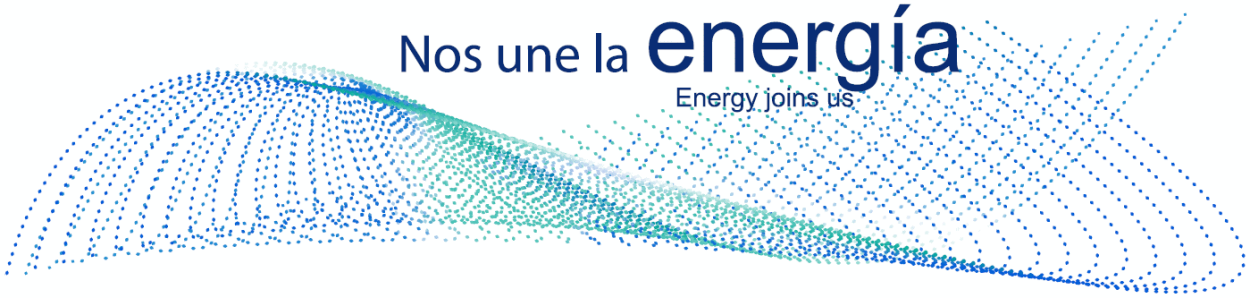

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