



# STATE OF PLAY OF SUSTAINABLE BUILDING IN LATIN AMERICA 2014

UNITED NATIONS ENVIRONMENT PROGRAMME



**Sustainable Buildings  
and Climate Initiative**

*Promoting Policies and Practices for Sustainability*

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# State of Play of Sustainable Building in Latin America



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# Acronyms

## **Argentina**

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LCA - Life Cycle Analysis

AEP - Agency Environmental Protection

CTRSB - Center of Technology Research for Sustainable Building

CBAS – Corporación Buenos Aires Sur

IPCC – Intergovernmental Panel on Climate Change

COP – Conference of the Parties

SAYDS: National Secretariat of Environment and Sustainable Development

COPANT – Pan American Standards Commission

NCCS - National Climate Change Strategy

ENARSA – Energía Argentina, S.A.

ENCC – Estrategia Nacional de Cambio Climático

GHG – Green House Gases

CO<sub>2</sub> – Carbon Dioxide

GENREN – Power Generation Program from Renewable Energy

AISD - Argentinean Institute for Sustainable Development

AISB - Argentinean Institute of Sustainable Building

NIIT – National Institute of Industrial Technology

IPCC – Intergovernmental Panel on Climate Change

SNE – National Energy Secretariat

IRAM – Argentine Normalization and Certification Institute

ISO – International Organization for Standardization

ISO 15392:2008 – Sustainability in building construction

ISO 21929-1:2006 – Sustainability in building construction. Sustainability indicators

ISO 21930:2007 - Sustainability in building construction. Environmental declaration of building products

LEED – Leadership in Energy and Environmental Design

BREEAM – Building Research Establishment Environmental Assessment Methodology

MW – Megawatts

NGO – Non-governmental organization

PROCAE – Electrical Appliance Quality Programme

PURE – Program for the Rational Use of Energy

PUREE – Program for the Rational Use of Electric Energy

SADS – Secretariat of Environment and Sustainable Development

SPV – Public Housing Service

SCN – Second National Communication

FCCC – Framework Convention on Climate Change

SDUyV – Sub-Ministry of Urban Development and Housing

CCU – Climate Change Unit

UNEP – United Nations Environment Programme

USGBC – United States Green Building Council

## **Brasil**

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UNFCCC - United Nations Framework Convention on Climate Change

ABRAFATI – Brazilian Coatings Manufacturers Association

NEB – National Energy Balance

BGBC – Brasil Green Building Council

CBCS – Brazilian Council of Sustainable Construction

CBIC – Contractors Bonding and Insurance Company

CONPET – National Programme of Rationalisation of the Use of Oil Products and Natural Gas

ECICII – Joint Corporate Structure in the Euroregion for Promoting and Attracting International Investment

HEQ – High Environmental Quality

INMETRO – National Institute of Meteorology, Quality and Technology

CERTIFICASOL – Certification for Water Heating Equipment

IPEEC – International Partnership for Energy Efficiency Cooperation

IPTU – Taxation for the Brazil Real Estate and Land Investor

MCyT – Ministry of Science and Technology

ME – Ministry of Environment

ONU – Organización de las Naciones Unidas

PAC – Growth Acceleration Plans

PORCEL – National Program of Energy Efficiency

## **Colombia**

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AMVA – Metropolitan Area of the Aburrá Valley

CAMACOL – Colombian Chamber of Construction

CCCS – Colombian Council of Sustainable Construction

DNP – National Planning Department

ECDBC – Colombian Low Carbon Development Strategy

FIC – National Professional Training fund for the Construction Industry

FNA – National Savings Bank

IFC – International Finance Corporation

MADS – Ministry of Environment and Sustainable Development

MDL – Clean Development Mechanism

MIB – Integrated Neighborhoods Improvement

ODM – Millennium Development Goals

PIB – Gross Domestic Product

PIPE – Plan to Boost Productivity and Employment

PNACC – National Plan for Climate Change Adaptation

PND – National Development Plan

PROURE – National Program for the Rational and Efficient Use of Energy and Renewable Energy.

RETEVIS – Technical Regulations for Energy Efficiency for Social Housing

SENA – National Learning Service

UPME – Mining and Energy Planning Unit

## **Chile**

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ACHEE – Chilean Agency for Energy Efficiency  
CCS – Sustainable Construction Code  
CEV – Housing Energy Rating  
ENCC – National Climate Change Strategy  
ENCS – National Strategy for Sustainable Construction  
ENE – National Energy Strategy  
ERNC – Non-Conventional Renewable Energy  
INE – National Institute of Statistics  
MINEDUC – Chilean Ministry of Education  
MMA – Ministry of Environment  
MVU – Ministry of Housing and Urbanism  
PAEE – Action Plan for Energy Efficiency  
PANCC – National Action Plan on Climate Change  
PEEEP – Program for Energy Efficiency in Public Buildings  
PNDU – National Urban Development Policy

## **México**

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AEAAE – Association of Companies for Energy Conservation  
ARA – Consorcio ARA, S.A.B. de C.V.  
CCAAN – Commission of Environmental Cooperation for North America  
CEV – Housing Building Code  
CFDF – Financial Code of Distrito Federal  
CMIC – Mexican Chamber of Construction Industry  
CMNUCC – United Nations Framework Convention on Climate Change  
CONAFOVI – National Housing Fomentation Commission  
CONAPO – National Population Council  
CONAVI – National Housing Commission  
CONUEE – National Commission for Efficient Energy Usage  
COPES – Promoter Committee of Sustainable Buildings  
DUIS – Integrated Sustainable Urban Developments  
ENCC – National Climate Change Strategy  
ENVS – National Strategy for Sustainable Housing  
FONADIN – National Infrastructure Fund  
FOVISSTE – Housing Fund of the Institute of Security and Social Services for State Workers.  
GEF – Global Environment Facility  
GIZ - Gesellschaft für Internationale Zusammenarbeit  
GPEDUIS – Promotion and Evaluation Group of Integrated Sustainable Urban Developments  
IMEI – Mexican Institute of Intelligent Building

INECC – National Institute of Ecology and Climate Change

INEGI – National Institute of Statistics and Geography

INFONAVIT – National Housing Fund Institute for Workers

ITESM – Instituto Tecnológico y de Estudios Superiores de Monterrey

LGCC – General Law on Climate Change

MDL – Clean Development Mechanism

NAMA – Nationally Appropriate Mitigation Action

PECC – Special Climate Change Program

PND – National Development Plan

PNUD – United Nations Development Programme

PoA – Program of Activities

PRONASE – National Program for Sustainable Use of Energy

SEDESOL – Ministry of Social Development

SENER – Ministry of Energy

SHF – Feredal Mortgage Society

SISEViVe – Green Housing Evaluation System

TLCAN – North American Free Trade Agreement

UNAM – Universidad Nacional Autónoma de México

UNDP - United Nations Development Programme

VINTE – Corporativo VINTE

ZEH – Zero Energy Homes Program

## **Peru**

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BRE – Building Research Establishment

CEA – Environmental Studies Center

CPCS – Peruvian Council for Sustainable Construction

GASR - Support Group for the Rural Sector

IIAP – Research Institute of the Peruvian Amazon

MDL – Clean Development Mechanisms

MVCS – Ministry of Housing, Construction and Sanitation

OMA – Environmental Bureau

PGAS – Sectoral Environmental Management Plan

PNA - National Environmental Policy

PNAA – National Environmental Action Plan

SENACE – National Environmental Certification Service for Sustainable Investment

SENEIA – National System of Environmental Impact Assessment

SINIA – Environmental Information System

UBS – Basic Sanitation Unit



## **Other countries**

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ADSC – Alliance for Sustainable Development in Central America

BUN- CA – Red Energy Foundation

CCAD – Central American Commission on Environment and Development

CCVAH – American Council on Housing and Human Settlements

PEER – Regional Energy Efficiency Program

SISCA – Ministry of the Central American Social Integration

### **Guatemala**

ABG – Banking Association of Guatemala

AEE – Energy Saving and Efficiency

ANACOVI – National Association of Home Builders

BID – Inter-American Development Bank

FIDE – Trust for Electric Energy Savings

GGBC – Guatemala Green Building Council

MEM – Ministry of Energy and Mines

PIEE – Integral Energy Efficiency Plan

PNCC – National Climate Change Policy

SEGEPLAN – Ministry of Planning and Programming of the Presidency

### **Panamá**

CGIEE – Manager Committee of Energy Efficiency Ratings

CPC – Panamanian Chamber of Construction

ICEX – Spanish Institute of Foreign Trade

OBG – Oxford Business Group

PCTEP – Spain-Portugal Border Cooperation Program

SNE – National Secretariat of Energy

UREE- Strategic Plan for the Rational Use of Electric Energy

### **Costa Rica**

CST – Certification for Sustainable Tourism

ENCC – National Climate Change Strategy

INAISE – International Association of Investors in the Social Economy

INTECO – Institute of Technical Standards Costa Rica

MAET – Ministry of Environment, Energy and Telecommunications

PEEST – Regional Energy Efficiency Program for Small Hotels

PND – National Development Plan

UICN – International Union for the Conservation of Nature

## **Vivienda Sostenible en América Latina**

BRE – Building Research Establishment

CAMACOL – Colombian Chamber of Construction

CEV – Housing Energy Rating

CONAVI – National Housing Commission

CONUEE – National Commission for Efficient Energy Usage

DPA – Department of Environmental Protection

DUIS – Integrated Sustainable Urban Developments

ENE – National Energy Strategy

ENCS – National Strategy for Sustainable Construction

ENVS – National Strategy for Sustainable Housing

GEI – Greenhouse Gases

HEQ – High Environmental Quality

IDB – Inter-american Development Bank

MIB – Integrated Neighborhoods Improvement

MSGG – Ministry General Secretariat of Government

ONU – United Nations

PND – National Development Plan

PPPF – Protection Program Homestead

RETEVIS – Technical Regulations for Energy Efficiency Housing Project

RETIE – Technical Regulations for Electrical Installations

RETILAP – Lighting and Street Lighting Regulation

SUSHI – Sustainable Social Housing Initiatives

## Foreword



**Arab Hoballah**

*Head of Sustainable Consumption and Production Division of Technology, Industry and Economics of UNEP  
(Source: dw.de)*

### **SBCI - State of Play of Sustainable Building in Latin America**

The State of Play of Sustainable Building in Latin America is a baseline for policy making and cooperation on sustainable buildings, including social housing, and has been developed in the context of UNEP Sustainable Buildings & Climate Initiative (SBCI), Global Initiative for Resource Efficient Cities (GI-REC), and Sustainable Social Housing Initiative (SUSHI).

The report provides a general picture of the current situation regarding public policies, programs and initiatives on sustainable building in Latin America through the study of six major countries in the region - Argentina, Brazil, Colombia, Chile, Mexico and Peru - and through the overview of the sustainable building context of Costa Rica, Guatemala and Panama. The main initiatives of each country on sustainable social housing are also analyzed. The Mexico Green Building Council (GBC) and the Tecnológico de Monterrey team prepared the report under UNEP-SBCI supervision and in collaboration with several GBCs in the region.

For each country, the State of Play presents the national context including considerations on energy consumption and climate change, and on the building and construction, and social housing sectors. It identifies the main agencies developing research on building sustainability issues and describes existing regulations and voluntary agreements on which future initiatives for the promotion of sustainable building could be based.

The report also analyses programs performed by public institutions on buildings and energy efficiency, and presents sustainable building case studies, lessons learned and recommendations to promote sustainability trends at a national and regional level.

What emerges from the State of Play is that:

- Latin American countries are at different stages of development and implementation of public policies for sustainable building. In various countries policies are still to be defined as in most cases alignment with and integration in national development and environmental strategic plans are to be adequately done.
- Awareness is growing about the challenges that the building sector poses to the region's energy model and interest is emerging on the opportunity to redefine building sustainability parameters to reduce both energy consumption and GHG emission.
- Green certification schemes are being developed at a national level and Brazil, Mexico and Chile are already among the 10 countries with the highest number of LEED certified buildings globally. However, compared to the regular construction, the number of green/sustainable certified buildings is still minimal in the region.
- Latin America faces a large and growing housing deficit (e.g. 2 million dwellings in Argentina, more than 1 million in Colombia), and the economic and environmental impact of the construction and operation of social housing becomes a crucial point to consider for the planning of sustainable building initiatives in the region.
- Countries such as Brazil, Chile and Mexico have developed national strategies for sustainable social housing integrating energy efficiency, water and waste management and health and social welfare concepts. Despite these initiatives, sustainability criteria still need to be mainstreamed and fully integrated in the social housing programs on a regional scale.

UNEP hopes that this report and its findings will trigger more strategic attention to challenges and opportunities related to sustainable buildings, social housing and resource efficient cities in the Latin America region and will serve as baseline for the development of relevant awareness raising actions, policies and tools.

# Introduction

The United Nations Environment Program's, Sustainable Building and Climate Initiative (UNEP-SBCI), is a partnership of major public and private sector stakeholders in the building sector, working to promote sustainable building policies and practices worldwide.

UNEP-SBCI works to promote a worldwide adoption of sustainable building and construction practices. It draws on UNEP's unique capacity to provide a global platform for collective action. To accomplish this mission, UNEP-SBCI has developed tools and strategies, established baselines and demonstrated, through pilot projects, the important role of the building sector in mitigation to climate change.

UNEP-SBCI has developed tools and strategies with the objective of integrating sustainable building practices to the construction sector. Some of them include:

- The Policy Quick-Scan Tool is developed in the context of the Sustainable Building Policies in Developing Countries (SPOD) projects, and enables national and local authorities to review the current policy settings affecting the support for sustainable buildings practices (if any) and to identify interventions/changes that could generate substantial improvement of energy efficiency and CO<sub>2</sub> reductions in the building sector at a low cost.
- The Common Carbon Metric-Protocol for measuring energy use and reporting Greenhouse Gas Emissions from Building Operations, proposes to provide globally applicable common metrics for measuring and reporting the energy use in GHG emissions from existing building operations. It also sets international baselines that can be used by architects, designers and the construction sector in general.

UNEP also promotes specific actions in the social housing sector through its Sustainable Social Housing Initiative (SUSHI). This initiative draws the most relevant research conclusions and experiences of UNEP-SBCI and aims to find the best cost-effective strategies to incorporate sustainable solutions in low-cost housing. It works to strengthen local capacities for their incorporation in national social housing programs. SUSHI was implemented in Sao Paulo, Brazil and Bangkok, Thailand from 2009 to 2011, and in India and Bangladesh from 2012 to 2014.

The Global Initiative for Resource Efficient Cities (GI-REC) seeks to connect the many different entities around the world working on Resource Efficiency, and using UNEP's convening ability to mobilize partners and different constituencies from governments at both the national and local levels, civil society, business and industry and other major groups. The ultimate goal of the GI-REC is to mainstream resource efficiency and sustainable consumption and production into policies and tools at the city level and to change citizens' and business' habits accordingly.

The World Green Building Council (WGBC) is a network of national green building councils in more than one hundred countries, making it the world's largest international organization influencing the green building marketplace. The World GBC's mission is to strengthen green building councils in member countries by championing their leadership and connecting them to a network of knowledge, inspiration and practical support.

Green Building Councils are member-based organizations that empower industry leaders to effect the transformation of the local building industry towards sustainability. With one hundred thousand buildings and almost one billion square meters of green building space registered, the influence and impact of this global network is a significant force for social and environmental change.

# Research Methodology

**The State of Play of Sustainable Building in Latin America** is a compilation of the main public policies, programs, case studies, research organizations, and initiatives associated with green building practices in nine Latin American countries (Argentina, Brazil, Colombia, Chile, Mexico, Peru, Guatemala, Panama and Costa Rica).

The first phase of the research was carried out in coordination with the Green Building Councils (GBCs) from each country. As local experts, the GBCs provided key information about the current situation of the sustainable building sector in their respective countries. The second stage consisted of a desktop research, based on secondary sources such as international organizations, local government's public information and other reliable sources, with the objective of presenting a broader perspective of the main green building initiatives within each country. The third and last phase consisted of a final review of the results by green building experts and the GBCs.

**The report provides a general overview of the main sustainable building initiatives in nine Latin American countries, thus it does not intend to present a comprehensive list of existing programs/initiatives in the region, but rather a compilation of the most relevant ones. Foremost, the information included in the report is subject to the data available during the period of research (June 2013- March 2014).**

To clearly identify the current state of sustainable building initiatives in the nine selected countries, the report presents the progress of each one in two main technical areas: (1) energy efficiency initiatives for buildings and (2) sustainable building practices. The main public policies, standards, practices and initiatives related to these two topics are gathered and presented in a comparison table that portrays each country's progress in both subjects. The information presented for six of the nine countries (Argentina, Brazil, Colombia, Chile, Mexico and Peru) is structured in the following way:

1) **Context** – A general overview of each country, which addresses the following topics: climate change international agreements; the country's position regarding climate change and main climate change initiatives; Greenhouse Gas (GHG) emission inventory by sector; national energy consumption by sector and general context of the construction sector.

2) **Baseline** – Sets the public policy framework that promotes energy efficiency and green building actions and practices, by analyzing the main national plans and strategies on topics such as climate change, sustainable development, energy efficiency, urban development and construction.



- 3) **Laws, Decrees and Standards**– Lists a general overview of the main laws, decrees and standards regarding energy efficiency and sustainable building.
- 4) **Institutional Programs** – Lists official programs, established by local or international authorities on energy efficiency and green building.
- 5) **Research Organizations:** - General overview of local organizations specialized in the research and development of green building policy, practices and initiatives (public and private).
- 6) **Case study** – Presents specific cases where green building practices have been implemented in construction projects (with a special focus on social housing projects).
- 7) **Future Actions** – Highlights initiatives that are currently in the process of development and gives recommendations for future public policy making.
- 8) **Lessons Learned** – Summarizes key progress in each country.

*\* Information for Guatemala, Panama and Costa Rica is presented in a more condensed and general form.*

For the purpose of this report, **sustainable or green building** refers to the approach in which the construction industry acts to promote sustainable development principles, taking into account environmental, social, economic and cultural aspects in construction projects. Green building seeks to minimize the environmental impacts of constructions in all of its stages (design, construction, operation and maintenance), employing solutions such as energy efficiency, renewable energies, bioclimatic design and passive solar systems, low environmental impact materials, site selection, water management and reuse, social welfare and air quality, among other principles.

On the other hand, **energy efficiency in buildings** refers to buildings that minimize the use of conventional energy, with the objective of promoting a rational use of the resource. Some of the most common strategies to achieve energy efficient buildings are the implementation of thermal, heating, lighting and refrigeration technical standards, among other measures.

# Executive Summary

**The chapter Sustainable Building in Latin America is a general introduction to the current situation of the green building sector in the Latin American region.**

This chapter sets a general context of key subjects, such as energy efficiency and the importance the topic has acquired in Latin America's country's National Development Plans, as a strategy to improve economic, social and environmental welfare, and as a means to tackle climate change. Another key topic is green building voluntary certifications, which in some countries have served as catalyzers for the green building market growth. Also, the establishment of sustainable building codes and standards that are adapted to the particular needs of each country are of great relevance for the sector.

Furthermore, an increasing tendency in the development of public policy frameworks, focused on sustainable social housing is observed among the region's most innovative countries (Mexico, Brazil and Chile). Final remarks of the chapter stress that despite the significant progress in some countries, the region's general situation is currently in an initial stage of development and implementation of public policies and initiatives to promote green building.

**Chapter I is focused on the current situation of the green building sector in Argentina.**

The country has invested its efforts on the development of public policies and programs related to energy efficiency, where the construction sector is incorporated as a supporting platform to achieve reductions of electric energy demand. The most developed policies, technical standards and programs are related to the compulsory and voluntary implementation of energy efficiency measures, through solutions such as: thermal conditioning and insulation technical standards, energy efficiency labels for heating systems for buildings, efficient lighting replacement and renewable energies. Other green building practices are implemented, such as solid waste and water management, green roofs and material selection.

The Argentinean Institute of Normalization and Certification (IRAM) is currently developing one of the most relevant initiatives for the green building sector in the country. They are adapting and homologating a national green building technical standard, called Norma IRAM-ISO-15392, which is based on the ISO international system. In order to implement this and other building technical standards, each municipality establishes its own building code and sets incentives and regulations to encourage their implementation.



*The Rawson wind farm is the largest in South America. (Source: argentina.ar)*

Within the country, the province of Buenos Aires has made the most progress in incorporating sustainable guidelines into its local construction regulation; therefore it is common that other provinces take the Buenos Aires building code as a reference for their respective local codes.

Initial progress has also been made in the implementation of energy efficiency measures in social housing projects. This initiative has been coupled with the national objective of reducing the existing housing deficit, which in 2009 ascended to approximately 2,500,000 units. To do so, the government has developed social housing pilot projects, where energy efficiency and renewable energy policies are developed and then implemented in order to evaluate and monitor their effectiveness, followed by a process of refinement of the national technical standards and policy frameworks, integrating the project's learning outcomes.

Future recommendations include setting up national and international financial mechanisms that fund the establishment of formal organizations that monitor and evaluate the results of projects that have been implemented.

Also, the clear and adequate definition of the term "Sustainable Building" could facilitate the categorization of projects and could help establish parameters for a better public understanding of the term. Another recommendation is the explicit integration of sustainable building into the public policy agenda. Developing a green building national strategy can catalyze bottom-up and top-bottom initiatives and incentivize the use of voluntary international certification tools, and prepare the market for the implementation of the green building technical standard currently being developed by the IRAM. Finally, another future recommendation is that the government can begin implementing low cost structural incentives, such as density bonuses or expedited permitting processes that have low or no cost for the governments and encourage developers to build green.

### **Chapter II focuses on the main sustainable building initiatives in Brazil.**

Brazil has achieved the incorporation of a more holistic understanding of the concept of green building. The country stands out due to the implementation of a successful synergy between laws, decrees, programs

and incentives, and the use of local and international voluntary certification tools, as a strategy to promote green building projects in the country. Brazil is the fourth country in the world with more registered LEED (Leadership in Energy and Environmental Design) projects. However, even though currently LEED is the certification tool with more registered projects in the country, locally adapted certification tools have been developed in the last years, and they are increasingly becoming more popular and successful. AQUA, Selo Azul da CAIXA, Qualiverde certification, and Referente GBC Brazil are examples of locally adapted certifications for the commercial, residential and social housing sectors.

Brazil has established a national decree that compels the incorporation of sustainable measures in bidding processes of public contracts, which include contracts for the construction of public buildings. At the subnational level, each municipality is responsible for instituting a local construction code, and several local governments are promoting green building practices by establishing incentives such as green property taxes. One of the most relevant initiatives in this regard is the Qualiverde Rating System, implemented in Sao Paulo by mandate of a local decree, which offers fiscal incentives, in the form of discounts in property taxes, for construction projects that comply with the specifications of the rating system. The local government is still in the process of refining the policy framework and diverse incentives for the application of the Qualiverde Rating System.

The state faces two major challenges; to cover the existing housing deficit of approximately 5.8 million homes and to alleviate the country's poverty situation. For the construction sector, these challenges are being faced with a long-term vision that incorporates sustainability practices in existing and new buildings. Institutional programs such as Selo Azul da

CAIXA, Morar Carioca and Minha Casa, Minha Vida are examples of initiatives that respond to these challenges, by facilitating financial savings for home owners and incorporating elements of environmental care, energy efficiency and a more holistic view of sustainable building practices.

The construction sector is a key element of support of the National Strategy of Energy Efficiency, which has established a carbon emission reduction goal of 36.6 % to 38.9 % for the year 2020. The program PROCEL Edifica promotes the rational use of energy on buildings from the construction stage and has a labeling system that applies to new and existing buildings in the commercial, public and residential sectors.

It is also important to highlight the key moment that Brazil is currently going through, by hosting the World Cup in 2014 and the Olympic games in 2016. The government's and event committee's vision of incorporating sustainable building parameters in the new infrastructure shows a long-term vision, which could be an important catalyst for the development and growth of the green building sector in the country.

Finally, some recommendations for future policy and decision-making are: to integrate currently implemented green building initiatives in a national sustainable building strategy, which articulates a long-term vision that guides the country's actions to a more sustainable construction industry.

To establish an inter-ministerial committee responsible for pushing the national green building agenda and integrate other strategic government agencies.

Establishment of financial mechanisms that fund the evaluation and monitoring of implemented projects, to validate their performance and their actual achieved savings and benefits.



*Green City, the largest macroproject Housing and Social Interest Priority of Colombia (Source: amarillo.com.co)*

Also, by integrating the social housing sector into the energy efficient labeling system, there could be more certainty of the energy performance in housing developments.

Finally, the establishment of incentives for the implementation of voluntary certifications, such as the incentives established for the Qualiverde certification could be an important step for the green building market in the country.

### **Colombia's initiatives to promote green building are presented in Chapter III.**

Colombia has established low-carbon development as a priority in its National Development Strategy 2010-2014, where the construction sector is recognized as a key engine for the country's economic development. It establishes a vision of "friendly cities and housing developments" for future city growth, where parameters such as urban and environmental sustainability and risk management are incorporated into urban development plans.

Regarding energy efficiency initiatives, in 2001 the government enacted the Energy Efficiency

and Renewable Energies Law, which proclaims the rational use of energy as a national priority. On 2010, the government began the development of an energy efficiency sub-program focused on the social housing sector, which aims to contribute to the improvement of the user's quality of life, through the use of thermic materials and the implementation efficient lighting and the use of energy efficient appliances. Despite the progress made on energy efficiency policy-making, Colombia has not yet developed technical standards that set guidelines for building design and equipment, as operation strategies that establish maximum and minimum energy efficiency parameters.

However, recent initiatives include triangular cooperation agreements for the development of policies and programs that address energy efficiency in buildings. Such is the case of the Triangular Cooperation Agreement, Mexico-Colombia-Germany that served as a platform to share experiences such as Mexico's successful social housing program Hipoteca Verde (Green Mortgage), climate zoning, certifying organizations, methodologies to measure savings and the unique registry of sustainable housing.



Regarding public policies that seek to incentivize sustainable building, one of the most relevant is the Law Project No. 119 of 2012, still in the process of being approved, which intends to establish the sustainable requirements to grant tributary discounts and incentives for the implementation of sustainable building practices. Also, some of the most important instruments in a developing stage are the Energy and Water Efficiency Guideline for Buildings, Colombian Environmental Seal for Green Buildings, Seals of the National Saving Fund and the Technical Guideline of Energy Efficiency for Low-Income Housing. All of these instruments set a baseline that builds an institutional capacity to transit from the planning, to the implementation stage.

Among the recommendations for future initiatives and policy-making, are creating monitoring and evaluation systems to determine the performance of buildings where energy efficiency measures have been implemented. Also, given the fact that Colombia is one of the countries with more registered CDM projects, it is recommended to include building and social housing projects that consider energy efficiency measures, renewable energies and sustainable building practices. It is also recommended to strengthen and create south-south and north-south cooperation alliances and to create mechanisms for institutional capacity building, with the objective of closing any existing knowledge and experience gaps.

Finally, it is considered important that the state leads by example and sets the objective of implementing sustainability measures to all public buildings in order to incentivize the rest of the local market to apply a more sustainable building model.

#### **Chapter IV addresses the progress made in Chile.**

The country stands out from other Latin American countries for explicitly placing green building as a key topic in the national public policy agenda, through its National Strategy of Sustainable Building 2013-2020. This is a planning instrument that establishes strategies for the implementation of sustainable building practices, in alignment with other cross-sectorial strategic plans. Regarding implementation instruments, there are voluntary technical standards for sustainable building available. Also, in 2013 the Sustainable Dwelling Code was published and it's available for voluntary implementation from 2014. There is also significant progress in the private sector, as Chile is among the ten countries in the world with the most registered LEED projects.

Regarding progress made on energy efficiency policy, the Law 20.402 was enacted on 2009 and enables the Ministry of Energy to establish minimum energy efficiency standards and the creation of the Chilean Agency of Energy Efficiency, which is the body responsible of the implementation of energy efficiency measures. The country has also developed the National Energy Strategy 2012-2030 and the Energy Efficiency Action Plan, in which strategic actions to achieve energy efficiency in buildings are established. Regarding implementation instruments, Chile has developed energy efficiency technical standards that cover aspects such as building environmental design, efficient lighting and refrigeration and the use of eco-technologies.

Chile has become a Latin American pioneer as they have implemented the Housing Energy Rating System, which is a voluntary instrument that evaluates energy efficiency levels in new dwellings during their operation stage, and labels them according to their energy performance. The Chilean Agency of Energy

Efficiency has also developed energy efficiency programs for specific building sectors such as schools, commercial buildings, residential, social housing sectors, hospitals and health buildings, hotels, and offices among others.

Furthermore, a subsidy program for thermal reconditioning has been implemented for social houses that were built before 2007 and that do not comply with current thermal isolation regulations. Another institutional program is the Neighborhood Recovery Program where the community implements sustainable actions. These actions include lighting replacement, improvement of the building envelopes, equipment replacement and bioclimatic design for energy efficient buildings.

Finally, some of the future recommendations are the development of regional cooperation networks that provide technical capacities to local policy-makers, in order to align sustainable building policies among the different levels of government. The development of local incentives for the implementation of the Sustainable Dwelling Code is also recommended. Finally, given the fact that Chile is currently going through the implementation of its green building and energy efficiency policies, and governments rarely have the institutional capacity to execute all of their plans, it is recommended to establish public-private alliances, where the government shares responsibilities and benefits of implementing their strategies.

## **Mexico's progress is presented in chapter V.**

Mexico has achieved both the development and implementation energy efficiency and green building public policies, with special focus on the social housing sector. The country stands out for the recent development of the National Strategy of Sustainable Housing (NSSH) 2013, which is a strategic planning instrument that aligns key national strategies related to sustainable building, with the objective of obtaining more benefits from the already implemented programs. The NSSH draws upon the existing energy efficiency and green building programs and initiatives and aligns them into an integrated action plan. It aims to establish financial, evaluation and standard development mechanisms to promote the construction of sustainable housing projects, and transform the social housing market, towards a more sustainable model.

The Housing Law, enacted in 2006 establishes guidelines for the development of low-income housing, which include sustainability concepts, such as mechanisms to promote environmental care and the efficient use of energy and natural resources. Furthermore, Mexico has achieved the consolidation of a set of national programs that incentivize the efficient use of energy in the social housing sector. An example is the Green Mortgage program, through which low-income users are granted an additional credit for the implementation of eco-technologies and energy efficient appliances. This program has evolved into a second stage, which is the Housing Evaluation System, (SISEViVe - Eco Casa), which is a measurement system that determines the energy efficiency performance and environmental impact of dwellings, and it's employed as a tool to develop and promote incentives and resources for the sustainable housing sector.



Also, programs developed under the context of Clean Development Mechanisms and the NAMA are pioneering programs, where for the first time the social housing sector has been included. The NAMA intend to mitigate emissions from the housing sector, by providing additional financing to improve energy efficiency and to reduce water and fossil fuel consumption, which is achieved with the use of eco-technologies, improvements in the architecture design and the use of efficient construction materials. Furthermore, other successful programs that promote sustainable building practices such as DUIS, PCES, This is Your House and ZEG Zero Energy Houses Mexico are in place.

Mexico has also developed and implemented a set of energy efficiency technical standards for buildings (building envelope, thermal insulation, refrigeration and lighting standards, among others). Important progress has also been made in the green building sector with the recent publication of the technical norm NMX-AA,-164-SCFI-2013 Sustainable Building – Criteria and Minimum Environmental Requirements, which is a voluntary standard that proposes a set of environmental standards and criteria for buildings, and sets an indicator system to measure the level of sustainability in buildings.

Also, voluntary certification tools such as LEED, Earth Check and Green Globe have served as catalyzers in the private sector, where a



Johnson Controls Offices - LEED Certified (Source: Peru GBC)



*Panama Vista Social Holiday (Source: capital.com.pa)*

certified building has become an added value and an attractive form of investment.

Some future recommendations are capacity building in the local level for the implementation of the National Strategy of Sustainable Housing and the Sustainable Housing Building Code. Considering that Federal incentives mostly incentivize the use of renewable energies, it is recommended to extend them to cover broader sustainable building practices such as bioclimatic design and water and waste management systems, among others. It is also recommended to include to the National Strategy of Sustainable Housing a green building strategy for the residential, commercial and public sectors, with the objective of having an integral vision in all building sectors.

Finally it is recommended to adequate evaluation systems such as SISEVive-ecocasa to the non-residential sectors and the development of financing programs and mechanisms for these sectors.

## **Chapter VI addresses the initiatives undertaken in Peru.**

The state has incorporated the construction sector to their national energy efficiency agenda, through the Referential Plan for the Efficient Use of Energy 2009-2018, which establishes the goal of reducing energy consumption by 15 % to the year 2018. The Plan has set a number of strategic actions for the residential and public building sectors, however, little or null progress has been accomplished in the development of these actions. Furthermore, available energy efficiency technical standards, which are applicable to buildings, focus on refrigeration, solar panels, lighting and water heaters.

Currently, one of the government's most relevant initiatives to incorporate sustainability practices to the construction sector is the Sectorial Environmental Management Plan 2008-2016, promoted by the Ministry of Housing, Construction and Sanitation. The plan proposes the development of a series of strategic actions towards 2016, which have the objective of "promoting and boosting the development of sectorial activities in a



sustainable manner, in order to achieve an improved rural and urban environmental quality” (MVCS, 2008, pg. 13).

The actions include the development of a normative framework for the construction sector that considers environmental sustainability, and that promotes the rational use of resources linked to construction processes, by implementing reduction, reuse and recycling practices. Furthermore, the National Urban Development Plan intends to conduct the urbanization process, considering sustainability concepts for its development and promoting the rational use of natural resources.

Regarding institutional programs related to green building practices, the Environmental Certification program is one of the most relevant, given that it’s a transversal program that mandates that public constructions must comply with established environmental regulations. Such regulations are mainly focused on residual water management, and ensuring that construction projects are not located in natural protected zones.

Peru has relied on cooperation alliances for the development of technical capacities and the exchange of experiences in green building practices. Some of the international cooperation initiatives currently under development are: the Development and Implementation of a Sustainable Housing Code program; InterCLIMA, an annual experience exchange on low-carbon development and other sustainability issues; the project, Development of building guidelines and its relationship with climate change, and the development of a roadmap design to achieve sustainable buildings that are low in CO2 emissions to tackle climate change.

Finally, some of the most relevant future recommendations for the development of the national green building policy framework are: to achieve the execution of the Referential Plan for the Efficient Use of Energy, through the establishment of financial and capacity-building mechanisms; one of the most important challenges the country faces is the development of institutional capacities for the development and implementation of green building and energy efficiency policies.

Table 9.1 State of Play of Energy Efficiency in Buildings in Latin America.

	The State of Play of Energy Efficiency in Buildings in Latin America								
	Argentina	Brazil	Colombia	Chile	Mexico	Peru	Guatemala	Panama	Costa Rica
Energy efficiency labeling / certification for social housing	D	YES	NO	YES	YES	NO	NO	NO	NO
Energy efficiency guideline/code for social housing	YES	YES	YES	YES	YES	D	D	D	D
Subsidy and/or mortgage credit programs to incorporate energy efficiency solutions in low-income housing (design, construction and operation stage - eco technologies, bioclimatic design, thermal conditioning, etc.)	D	YES	D	YES	YES	NO	D	D	YES
Programs for the rational use of energy in buildings (with focus on the improvement of the building envelope and/or efficient lighting and refrigeration system)	YES	YES	YES	YES	YES	YES	NO	YES	NO
CDM and/or NAMA projects focused on building energy efficiency (efficient lighting and/or renewable energies)	YES	?	YES	YES	YES	YES	?	?	?
Implemented social housing projects that incorporate energy efficiency measures.	YES	YES	YES	YES	YES	NO	D	D	D
Energy efficiency technical standards for buildings that include at least one of these topics: thermal conditioning, thermal insulation, building envelope and/or bioclimatic design.	YES	YES	D	YES	YES	D	NO	D	NO
Energy Efficiency Law	YES	YES	YES	YES	YES	YES	D	YES	YES

Table 9.2 State of Play of Sustainable Building in Latin America,

	The State of Play of Green Building in Latin America								
	Argentina	Brazil	Colombia	Chile	Mexico	Peru	Guatemala	Panama	Costa Rica
Sustainable Building National Strategy	NO	NO	NO	YES	YES	NO	NO	NO	NO
National law that promotes sustainable building	NO	YES	D	YES	YES	NO	NO	NO	YES
Locally adapted certification tool for sustainable social housing	NO	YES	D	NO	NO	NO	D	NO	NO
Locally adapted certification tool for sustainable buildings	NO	YES	D	NO	YES	NO	NO	NO	NO
Sustainable social housing projects under CDM and/ or NAMA scheme	NO	?	NO	?	YES	NO	NO	NO	NO
Subsidy and/or incentive programs that promote the integration of sustainable building elements in social housing projects	NO	YES	D	YES	YES	NO	D	D	D
Subsidy and /or incentive programs to promote the integration of sustainable building elements in non-residential buildings	?	YES	D	D	YES	NO	NO	NO	YES
Sustainable social housing pilot projects	YES	YES	YES	?	YES	YES	?	?	YES
Sustainable building code (or guideline)	NO	?	D	YES	YES	NO	NO	NO	NO
Sustainable building technical standards	D	?	D	YES	YES	NO	NO	NO	YES
Law, decree and/or program that incentivizes green roofs	YES	YES	YES	YES	YES	YES	NO	?	YES
Compulsory environmental impact assessment	YES	?	YES	YES	YES	YES	?	?	YES

Furthermore, recommendations highlight the importance of achieving the goal of developing energy efficiency technical standards that set the minimum construction requirements of thermal conditioning, passive design, minimum energy efficiency levels and the use of eco-technologies. Finally, it is also recommended to create a transversal sustainable building strategy and a cross-sectorial green building committee that facilitates the interaction between the different governmental institutions.

**Chapter VII, Other Countries, addresses in a more general way the progress made in Guatemala, Panama and Costa Rica regarding green building practices.**

The Central American region stands out for its progress on the establishment of regional strategies of sustainable development, energy efficiency and regional environmental plans. Additionally, the three countries are part of a regional effort to develop sustainable building regulation oriented to the social housing sector.

Guatemala presents great opportunities to incorporate green building in the national public policy agenda. The country has recently established the national vision of incorporating sustainable development in key national policies, which is done through the National Development Plan 2032.

Furthermore, Guatemala is currently on the initial stages of integrating energy efficiency measures to the building sector. To do so, in the short term, they have established plans to develop a program for efficient public lighting and residential use.

Also, they have implemented pilot projects in public buildings where they have substituted regular equipment for energy efficient equipment. Additionally, a sharing experience program has taken part with diverse countries such as Mexico, who have provided technical assistance and capacity building programs for professional development, specialized in electricity efficiency and savings in Guatemala.

Panama shows a remarkable economic growth trend, which is the result of the government's central policy to promote foreign investment. In particular, the construction sector presents a dynamic growth where new market niches arise, such as the construction of hotels, offices, and restaurants, among others. The country has taken strategic steps towards the development of an institutional energy efficiency structure, which considers the building sector as a strategic line for the reduction of energy demand. Also, Panama is currently in the process of developing energy efficiency technical standards with application to buildings.

The standards focus on building insulation, air conditioning and refrigeration. Another key strategy is the program Mortgages with Rational Electric Energy Use (UREE), which is currently in a development stage and aims to grant discounts over the amount of paid interests for low-income houses that incorporate energy efficiency measures.

Costa Rica presents relevant progress in the adoption of green building practices. They have developed the technical standard, RESET –Requirements for Sustainable Buildings in the Tropic, which contemplates requirements for the design, construction and operation stages. It is based on the premise of achieving "sustainability with more architecture than technology", meaning that the standard intends to maximize the potential for design, before the use technologies. The country has developed energy efficiency technical standards focused on lighting systems, refrigeration and air conditioning. In this respect, one of the

recommendations for future development of standards is the incorporation of building insulation, thermal conditioning and bioclimatic design standards. Costa Rica has set the ambitious goal of becoming a carbon-neutral nation by 2021. To achieve this, they have integrated sustainable building in their Climate Change National Plan as a strategy to achieve energy demand reduction and climate change adaptation.

Chapter VIII present the main sustainable social housing initiatives for each country. The Latin American and the Caribbean region faces a serious problematic of housing deficit. It is estimated that on 2011 the housing deficit oscillated between 42 and 51 million units, from which approximately 45 % refers to a quantitative deficit and the rest refers to qualitative deficit. In this sense, the social housing sector has acquired more relevance because it aims to offer adequate living conditions to the poorest sectors of society.

However, the region also faces high environmental and social impacts, caused by the demand and construction of housing developments; through design, construction and operation processes, the housing sector is a direct consumer of resources, materials, water and energy.

Despite the fact that the definition of Green Growth is still under continuous debate and progress, it's a topic that in recent years has permeated the policy agenda of the social housing sector. International support in the region for the development of new or improved institutional structures, which consider a green growth paradigm, has been of key importance in the region. An example of this is the Sustainable Social Housing Initiative (SUSHI), developed by UNEP-SBCI to promote the implementation of sustainable building solutions in social housing programs in developing countries. The initiative provides guidelines and case studies for policy makers, so they can integrate sustainable solutions in the design, construction and operation of housing units. Brazil is the first Latin American country where SUSHI has been

implemented, achieving technical and political capacity building and providing concrete recommendations on sustainable solutions for the social housing sector.

### **Chapter IX presents the concluding remarks and general recommendations.**

Key policies, programs and initiatives on energy efficiency and sustainable building have been gathered and presented in two tables that provide a clear vision of each country's progress in both subjects. Common attributes of the countries' contexts are also highlighted. Tables 9.1 and 9.2 show the key initiatives on energy efficiency and green building.

Finally, future recommendations are established for policy-makers, national and sub national governments, and actors involved in the building and housing sector in Latin America.

- To explicitly position sustainable building in the public policy agenda, by developing a national strategy or plan that integrates and directs actions, with the objective of incentivizing sustainable building and have an adequate planning instrument to achieve it.
- To incorporate sustainable building concepts in strategic urban and city planning agendas.
- To integrate sustainable building policies and strategies in national transversal policies such as climate change, energy efficiency and social housing.
- Development of sustainable and energy efficient social housing projects under the NAMA and CDM schemes.
- Technical capacity building for the development of public policies and the implementation of sustainable building projects.
- Participation in Latin American and international sustainable building forums, where countries that have made more progress in sustainable building share experiences with countries that are still developing their institutional structure.
- Development of south-south cooperation initiatives to promote the exchange of resources, technology and knowledge among counties that are still developing their institutional structure.
- Development guidelines for the development of sustainable building public policies, instruments and programs.
- Development of sustainable building technical standards as in the case of Mexico and Chile and to promote the use of local and traditional sustainable building practices and integrate them and harmonize

# Introduction

## Sustainable Building in Latin America

Global warming is unequivocal; the atmosphere and the ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased (IPCC, 2013, pg. 4). Climate change represents a global risk to society because its effects threaten basic elements of life and people, such as access to water, food production, health, land use and natural, economic and physical capital (OECD, 2011). Developing countries are most vulnerable to climate change effects, in part due to an insufficient institutional capacity and adequate infrastructure to face the phenomenon.

It is estimated that from 2000 to 2020 urban population in Latin America and the Caribbean will increase from 76 % to 89 % (Cesano et al., 2013). Even though the current amount of GHG and CO<sub>2</sub> emissions produced by developing nations is minimum in proportion of the total global emissions, future predictions estimate that if the Latin American region were to follow

the same industrialization route of developed countries, GHG and CO<sub>2</sub> emissions will increase proportionally. In the midst of a rapid urbanization growth, derived from a significant economic growth in the last decades, Latin American countries are key players for the development and implementation of measures for climate change adaptation and mitigation and for the achievement of a sustainable growth (OECD, 2012).

In Latin America, buildings consume 21 % of water, 42 % of electric energy and produce 25 % of CO<sub>2</sub> emissions and 65 % of waste (Cesano et al., 2013). The global strategy, Sustainable Energy for All, promoted by the United Nations and The World Bank, has set the global goal of duplicating energy efficiency levels towards the year 2030 (IBE, 2012). Considering that the construction sector is responsible for consuming more than one third of the global energy, this sector holds a key potential for the achievement of efficient energy use and significant GHG and CO<sub>2</sub> reductions (UNEP, 2011).



The international experience recognizes that in the short, medium and long-term, the efficient use of energy is the most effective measure to achieve significant reductions of GHG and CO2 emissions (IBE, 2012). Furthermore, other sustainable building practices also have the potential of providing integral solutions such as resilience and adaptation to climate change, support in zoning and urban planning, water efficiency, waste management, biodiversity conservation and social and economic development, among others. However, it is important to recognize that in most Latin American countries, national priorities are centered on economic development, education provision, food production, national security and the provision of adequate housing and basic services. In this context, ideal conditions strive to couple green growth and the development of green infrastructure with social and economic development.

In the past years, energy efficiency has become a central strategy in Latin America's countries' National Development Plans, due to the economic and social benefits energy efficiency measures delivers. According to the Inter American Development Bank, out of all the unexploited sources of clean energy available in Latin America, energy efficiency is the measure that offers the most impact at the lowest cost (BID, 2014). Such is the case, that countries like Argentina, Brazil, Colombia, Chile, Mexico, Peru, Panama, Guatemala and Costa Rica show a clear tendency towards the development and implementation of public policies, programs and initiatives oriented to the achievement of energy efficiency. In some countries, such strategies incorporate the construction sector through strategies such as construction codes that establish minimum parameters of energy efficiency, subsidies for the improvement of thermal conditioning, incentives for the certification of energy efficient buildings, technical standards of energy efficiency and building and house energy efficiency labeling, among others.

Besides the progress accomplished on energy efficiency measures, the Latin American region has shown a marked tendency towards the development of policy frameworks specifically oriented to promote the implementation of sustainable building measures, with the aim of achieving new construction paradigms. In general terms, the available mechanisms to promote green building in the region are: market instruments (such as commercial loans, project financing – Clean Development Mechanism and green building certification tools), public policies (subsidies, incentives, construction codes, certifications and conditional permits) and international cooperation mechanisms (multi lateral banking and labeling) (Cesano et al. 2013).

One main challenge for the successful development and implementation of sustainable building practices at the local level is the incorporation of the sector as a priority subject into the national public policy agenda (UNEP, 2009). To face this challenge, the inclusion of green building policies and strategies into the different transversal and sub national agendas is necessary. Such agendas include national climate change plans, energy efficiency strategies, urban development and social housing plans, along with the development of tools that provide credibility and show clear indicators of energy efficiency performance and CO2 reductions, derived from the building sector *ibid*. Some Latin American countries are proving that it is possible to overcome such challenge and have begun to pave the first steps towards the consolidation and implementation of green building regulatory frameworks and national and sub national strategic actions.

Countries such as Chile and Mexico have developed national social housing strategies and green building strategies, that in addition to energy efficiency measures, include concepts such as water and waste management, social wellbeing and health, innovation, competitiveness and monitoring during the



*The issue of energy efficiency has been a central part of national development strategies in Latin American countries. (Source: victor-ciumac.blogactiv.eu)*

operation stage of the building, among others. Brazil, Argentina, Mexico, Colombia, Chile and Costa Rica have made significant progress in the development of locally adapted green building codes and technical standards, which represents a remarkable achievement for the sector. It is also important to acknowledge, that international cooperation platforms have played a key role in countries' progress, where technical capacities, technology and financing mechanisms to facilitate the development of sustainable building public policies have been exchanged.

In countries like the United States and some Latin American regions, voluntary certification tools have been growth catalyzers for the local green building market. Examples of this are Chile, Brazil and Mexico, that are among the ten countries with more LEED registered and certified projects, right after United States, Canada, Turkey and India; Chile has 203 certified projects, Mexico registers 356 certified projects and 717 for Brazil (USGBC, 2013). In this context, green building has

been successful in the private sector due to demonstrated benefits such as: return on investment, climate change mitigation, energy security, resource conservation, job creation, air and environment quality improvements, enhanced productivity of building users, life quality and long-term resilience (WGBC, 2013).

In line with the progress made in the private, commercial and public sectors, Latin America presents a growing market, focused on implementing sustainable building practices in the social housing sector. For the past twenty years, the housing situation has improved due to national governments' efforts to provide appropriate housing conditions. However, most of the Latin American region presents an aggravated housing deficit that keeps the whole of the population from accessing to adequate housing conditions (ONU, 2012).

Thus, the provision of adequate housing conditions for the most vulnerable sectors of the population, represents one of the main challenges and priorities that the region faces.

As an example of the previous remark, Mexico has implemented a national sustainable social housing program, called Hipoteca Verde (Green Mortgage), which allows low-income families to access adequate housing, equipped with eco-technologies and construction methods that promote energy efficiency and water management. Likewise, Colombia has taken Mexico's example and is currently in the process of adopting the Green Mortgage program. Same with Brazil, where locally adapted green building certification tools for the social housing sector have been developed and also, UNEP's Sustainable Social Housing Initiative (SUSHI), has provided institutional capacity building in technical and policy-making areas, for the integration of sustainability parameters in the social housing sector.

In the case of the Central American region, Panama, Guatemala and Costa Rica, through the Central American Council of Housing and Human Settlements, along with the technical assistance of the Central American Social Integration Secretariat, have promoted the development of a program called, Promotion of Energy Solutions on the Design and Implementation of Human Settlements (CCVAH, 2013). The program consists on the development of regional guidelines for sustainable housing, planning, design, construction and financing *ibid*. To achieve this, the region has worked on the development of legal frameworks that establish guidelines that include sustainability elements for the development of social housing projects.

Despite the significant progress made on green building initiatives, it is important to stress that the Latin American region is still on an initial stage, with a long way to go to in order to make initiatives, strategies and policy frameworks a reality. Some countries like Brazil and Mexico have accomplished greater progress in the implementation stage, nevertheless, the green building industry in these countries still represents a minimum proportion compared to the regular construction practices.

The present report intends to provide a general view of the current situation of nine Latin American countries (Argentina, Brazil, Colombia, Chile, Mexico, Peru, Guatemala, Panama and Costa Rica) regarding green building public policies, programs and initiatives. The report doesn't intend to include all of the existing initiatives in each country, but rather, it intends to provide a general perspective that allows a better understanding of the orientation and progress of public policies and initiatives in each country. The progress in each country is then determined by analyzing and comparing the regulatory frameworks and implemented actions on two main subjects: energy efficiency and green building from a more holistic and integral perspective.



# Argentina



# 1.1 Context

According to the National Census of 2010, the Republic of Argentina has a population of 40,117,096 inhabitants. It is one of the most important economies in Latin America, with a strong presence on the South American region. It's a republican, representative and federal State, with a decentralized political system, integrated by 23 provinces and the autonomous city of Buenos Aires, where most of the population is concentrated (38.9 % of the total population) (SDUyV, 2010). Environmental protection is incorporated in the country's Constitution (Art. 41), granting each province the jurisdiction over its natural resources, under the consideration of the established national minimum budget for environmental protection (SCN, 2008).

Argentina takes part in the efforts of the international community to implement measures for mitigation and adaptation to climate change. In 1994, through the law 24.275, the country ratified the United Nations Framework Convention on Climate Change (UNFCCC) and on 2001 it ascribed to the Kyoto Protocol, through the law 24.295. The government of Argentina publishes their strategies and actions for the compliance of their international agreements to the UNFCCC through their national communications; the first one published on 1997 and the second one on 2008. Additionally, the country has hosted the Conference of the Parties on two occasions, COP 4 on 1998 and COP 10 on 2004 (SAyDS (a), 2014).

According to the national inventory of GHG emissions of the year 2000, published in the Second National Communication in 2008, the energy sector produced 47 % of the total national GHG and CO<sub>2</sub> emissions (SCN, 2008). Argentina occupies the fourth place among the Latin American countries that consume more energy; this prompted the government to give special attention to energy efficiency (Banco Mundial, 2008). Up to 2013, electric energy consumption by sector was distributed as follows: transport, 28%, residential use, 25 %; industry, 24 % and commercial and public use, 8 %, agricultural use 5 % and non energy consumption, 10 % (SDE, 2012). In summary, the energy consumption of the residential, commercial and public sectors represent approximately 57 % of the total net consumption.

Between the years 2002 and 2005 the construction sector had an accumulated growth of 84.5 % in respect with the growth of the sector in the nineties, and produced 8.2 % of the total urban jobs in the country (SCN, 2008). In 2012, the Argentinean Construction Chamber published a proposed inventory of public projects for the Urban Planning period of 2012-2021.

The total estimated investment for the construction sector is approximately \$3,531,165,858.878 Argentinean Pesos (434,337,743 USD) and the proposed distribution for the building sectors is allocated as follows: housing sector, 28.36 % (social housing, 5.9 % and middle class housing, 22.46 %); transport sector, 0.03 % (building of transport terminals); health sector, 1.84 % (new constructions of hospitals and medical centers and maintenance of existing hospitals); education sector, 1.37 % (new buildings and maintenance of existing buildings); security sector, 0.07 % (construction of penitentiary centers); urban infrastructure, 0.06 % (construction of new administrative public buildings); other sectors – tourism, 0.52% (hotels) (Galilea et. al, 2012).



According to these numbers, the resources destined for the construction of new and existing public buildings, represents approximately 32.25 % of the total urban construction budget.

Housing deficit is a problem that affects a great number of Latin American countries, and Argentina is not the exception. It is estimated that on the year 2009 the national housing deficit rose approximately to 2,487,583 houses and more than 3,000,000 houses presented a qualitative deficit, meaning houses that required physical restoration, that do not have access to sanitary services and/or that are located in overcrowded locations (Lazzari, 2009). In this respect, the housing deficit must be approached not only from a quantitative perspective, but also from a qualitative one that includes elements of urban integration *ibid*. It is in this context, that the social, environmental and constructive solutions that green building techniques can deliver, acquire national relevance.

The use of sustainable building practices has acquired relevance in media publicity in the city of Buenos Aires, as well as on the rest of the provinces; this is the result of incorporating environmental matters into urban planning and architectural design (Galli, 2013). This can be noticed on the new national and sub national institutional governance structures, which have been developed on one hand, vertically, from the national level, through public policies, programs, national strategies and new governmental agencies.

On the other hand, they are also built in a horizontal way, in the local level, through interaction and cooperation processes between the different sectors, government agencies, Non-Governmental Organizations (NGOs), research organizations, individuals and interest groups.



Cover:View from Port Madero Office Building, one of the sustainable buildings in Argentina. (Source: [visionsustentable.com.ar](http://visionsustentable.com.ar))

On this page: La Casa G, first fully sustainable house in Argentina. (Source: [sustentator.com](http://sustentator.com))

## 1.2 Baseline

There are currently key initiatives in place that set up the basic structure for the development of a sustainable building policy framework. In general terms, the most relevant ones are: public policies for the implementation of national energy efficiency programs, thermal conditioning technical standards and green building voluntary technical standards.

The Argentinean Institute of Normalization and Certification (IRAM) is currently developing a green building technical standard, based on the ISO system. There are also a series of standards, codes and programs available that independently promote the application of green building techniques, such as the energy efficiency and thermal conditioning technical standards. In this context, the construction of a transversal institutional structure is an important challenge to achieve, in order to establish green building practices as an

institutional policy that contributes to social development and environmental protection. On the other hand, the use of voluntary certification tools, such as BREEAM, ISO or LEED, which facilitate the homogenization of green building parameters, have acquired increasing importance in the country. Especially in the private sector, having a certification that ensures sustainability parameters and return on investment of a green building project is perceived as an added value (Galli, 2013). Up to January 2014, Argentina had a total of 73 LEED registered construction projects (where more of 50 % of them located in the city of Buenos Aires) and 11 projects that have been LEED Certified (USGBC, 2014).



*Solar Panels in Barrio La Perla. (Source: <http://cedu.com.ar/>)*

## 1.2.1 Laws, Decrees and Technical Standards

- The Decree No. 140/2007 of Energy Efficiency declares of national interest and priority the rational and efficient use of energy, highlighting that the issue is of permanent character with a long-term vision. In relation to the building sector, the decree states the need of establishing the National Program of Rational and Efficient Use of Energy (PRONUREE) in national public administration buildings
- The law 13059/03 of Thermal Conditioning establishes compulsory guidelines of thermal conditioning for new buildings, and establishes that all of the public and private buildings, destined for human use, constructed in the Province of Buenos Aires, must guarantee an adequate insulation.
- The Province of Buenos Aires, through the Law 4428, promotes the construction of green roofs and terraces on new buildings, and offers reductions in the payment of construction and delineation rights.
- The Law 449 and the Decree No. 222/20T2 establish guidelines regarding the execution of environmental impact assessments that analyze the interaction between construction projects and the environment.

Each municipality establishes their own building code and in many cases, provinces integrate clauses from the Buenos Aires Construction code to their local codes. There is not a national construction code available, but rather the country uses provincial and municipal construction codes (IRAM, 2013).

Derived from what was established in the PRONUREE (Decree No. 140/2007, Annex I, subsection 2.9), in 2009, the Ministry of Energy ordered the initiative of developing an energy efficiency labeling system for houses, and requested IRAM to develop a technical standard to achieve its objective. In May 2010, the technical standard IRAM 11900 Energy Efficiency Label for Heating Systems for Buildings was approved (SE, 2010). The standard establishes a simplified methodology to calculate the level of energy efficiency of building insulation for construction projects that were likely to use heating systems *ibid*. The energy efficiency levels are exposed in a label similar to the one used to certify the efficient use of energy in domestic appliances.

The technical standards related to energy efficiency, natural and artificial lighting and thermal conditioning include (Evans, 2012):

- IRAM technical standards: IRAM 11630 and IRAM 11659-1 (insulation in buildings); IRAM 11659-2 (thermal conditioning for buildings); IRAM 1739 (materials and thermal insulation); IRAM 62404 (energy efficiency labeling for electric lamps for general lighting); IRAM 62406 (energy efficiency labeling for air conditioning) and IRAM 210001-1 (solar collectors).
- Compulsory technical standards for "Minimum Quality Standards for Social Housing"
- Technical standards for hygiene and security in the working space
- Construction codes with application in the municipal level



These standards are implemented through the development of municipal codes or guidelines, where some are mandatory and regarding the voluntary ones, each local government decides which technical standards to incentivize in their construction codes (IRAM, 2013). An example of this is the green roofs or terraces, promoted by the local government of the city of Buenos Aires *ibid.*

Currently IRAM is on the process developing the technical standard called Norma IRAM-ISO 15392, done by the standardization of the ISO system of sustainable building (Evans, 2012). They are working on three main action lines for the implementation of sustainable building practices. The first one focuses on building and architectonic design, which includes topics such as material selection, construction processes, energy efficiency, resource management, among others (IRAM, 2013). They use the following baselines: ISO TC 268 (sustainable development for communities), ISO TC 205 (Built environment), ISO 13153:2012 (Guideline for the design process of energy efficient single-family housing and small commercial buildings) *ibid.* They also include the compulsory IRAM technical standards related to thermal conditioning.

The second action line is the standardization of environmental aspects of construction materials, by considering certifications or environmental labels of the products used for the construction, by performing a life cycle assessment. The third part of the standardization of the ISO system on sustainable building, takes as baselines the following systems: ISO 15392:2008 (General principles of building sustainability), ISO 21929-1:2006 (Guidelines for the development of sustainability indicators for buildings), ISO 21930:2007 (Environmental declaration of products), among others.

## 1.2.2 Institutional Programs



Landscape of Buenos Aires from the port. (Source: Picstopin.com)

### Energy Efficiency

For the publishing of the Second National Communication of 2008, five studies related to energy efficiency were carried out, which identified measures and mitigation policies that estimated a net reduction of 60 million tons of CO<sub>2</sub> eq. in a projected period of 15 to 20 years (SCN, 2008). Some of these measures include the implementation of the following programs:

- **National Program of Rational and Efficient Use of Energy (PRONUREE)**

PRONUREE was implemented based on the Decree No. 140/2007 and articulates the short, medium and long-term general actions to implement, through different programs for each strategic area, such as: industrial sector, commercial, service and education sector, co-generation, energy efficiency labeling, energy efficiency regulation, public lighting and traffic lights, transport, housing and climate change through Clean Development Mechanisms (CDM). Municipal initiatives to implement energy efficiency measures have been developed. Some examples of these initiatives are the

development and implementation of standards of rational use of energy, energy efficiency and environment, renewable energies, public lighting efficiency and urban solid waste management.

Also, four major initiatives were developed to implement energy efficiency measures in the commercial, residential, public and industrial sector. The first one consists on the improvement of the building envelope for housing and education sectors. Considering a scenario of maximum savings, it is projected that this initiative could save 497.8 Ktep/year of gas consumption and 1,170,130 of CO<sub>2</sub> tons. The second initiative consists on the substitution of incandescent lamps for compact fluorescent lamps in the residential, commercial and public sectors, with estimated energy savings of 471.2 Ktep/year and 1,109,481 CO<sub>2</sub> tons.

The third measure is oriented to the replacement refrigerators with an energy efficiency label. Finally, the fourth initiative is the implementation of the Program for the Rational Use of Energy (PURE) and the Program for the Rational Use of Electric Energy (PUREE), which estimate total savings of 878,725 CO<sub>2</sub> tons (SCN, 2008).

- **Program for the Rational Use of Electric Energy (PUREE)**

PUREE uses financial charges and bonuses to promote the application of energy efficiency measures in houses and buildings. In May 2005, the Ministry of Energy released the second version of the program, which arranged a bonus system for house and building users that save energy and additional charges for users that exceed the established limit of energy use (PUREE, 2013). The bonuses are granted to general house and building users who achieve minimum energy savings of 10 %, in respect to the same period of the year 2003, and to the users of medium and large electricity demands that save a minimum of 10 % of energy in respect to the same period of the year 2004. Likewise, charges are applied to residential users and low electricity demand companies that consume more than 300 k Wh in a period of two months and to medium and large electricity demand users who do not save a minimum of 10 % of energy in respect to the same period of the year 2004 *ibid*.

- **Home "Sustainbilizing" – Argentina**

EThe FOVISSE (Housing, Sustainability and Energy Forum) is a foundation that works on housing, energy and poverty issues with the aim of promoting energy efficiency and is responsible for the implementation the program. Home "Sustainbilizing" Argentina is based on the Weatherization Assistance Program, which is implemented in the United States and has the objective of providing a capacity building program to unemployed people, on low-income house auditing in order to identify the main areas of energy loss and possible health risks (FOVISSE, 2014). The project aims to obtain the following results:

- 1) Improvement of quality of life, derived from energy efficiency on homes.
- 2) Increased family budget.
- 3) More health and security.
- 4) Creation of green and sustainable jobs.
- 5) More available energy in the country.
- 6) Environmental impact reduction and
- 7) economic development.

## Sustainable Building

- **Green Roof on Public Buildings Program**

This program was created on 2010 by the Agency for Environmental Protection (AEP), with the objective of promoting the vegetation on public buildings in the city of Buenos Aires (APA, 2012). The incorporation of green roofs provides insulation benefits by reducing energy consumption destined for building cooling and heating and reduces CO2 emissions. Also, they collect water, serve as dust and contamination filters and provide a natural habitat for native species, among other benefits *ibid*. Through the law 4428, the province of Buenos Aires promotes the use of green roofs and terraces by reducing construction and delineation payments for new buildings. This incentive has resulted in the construction of green roofs and terraces, mainly on the commercial sector, nevertheless the program incentives any neighbor to implement the practice (BAC, 2013).

- **Sustainable Municipalities**

Sustainable Municipalities is a federal program that is implemented in the local level, which was created by the resolution No. 1493/2008 and is coordinated by the Environment and Sustainable Development Ministry (ESDM). The main objective of the program is to provide technical and financial assistance for the development of sustainable development local plans and to institutional capacities, especially on the municipalities that present more environmental and social needs.

The program incentivizes the implementation of local environmental public policies and the development of projects related to sustainable development (SAyDS(d),2014). con el desarrollo sustentable a nivel local (SAyDS(d),2014).

## 1.2.3 Research Organizations

- **Argentina Green Building Council (AGBC)**

NGO that aims to facilitate and promote the design and construction of sustainable buildings. They also intend to create awareness about climate change and environmental issues and provide support for the development of standards and sustainable practices for both existing and new urban developments (AGBC, 2014).

- **Center of Technology Research for Sustainable Building (CTRSB)**

The CTRSB is privately funded and was inaugurated on 2010 as a platform for research and technology training on sustainable building. They developed a prototype called CasaE, which is a model of an efficient house that intends to serve as an educating tool, focused on materials and advanced technology, for professional training on green building practices. The project saves approximately 70 % of energy and reduces water consumption and CO2 emissions. Additionally, the project applies to social housing and residential sectors (BASF, 2014).

- **Argentinean Institute of Sustainable Building (AISB)**

The AISB has been active for more than 30 years and has promoted the creation and adoption of public policies that support the use of cleaner and sustainable construction techniques, with the aim of building more sustainable communities, both considering the physical infrastructure and social dimension. Among their main objectives are the promotion of policies, methodologies and tools to achieve the development of sustainable communities, as well as the diffusion of energy efficiency principles and clean technologies involved in construction processes (IARCOS, 2014).

- **Argentinean Institute for Sustainable Development (AISD)**

NGO formed by a multidisciplinary group of professionals, that provides proposals and actions that improve sustainability on the government, productive and civil society sectors, promoting the modification of current consumption patterns (IADS, 2004). A remarkable initiative was the development of a guide for sustainable building for the province of Buenos Aires, which was oriented to all the key actors involved in the construction sector. It includes the best practices of sustainable building with the purpose of being a reference guide for new constructions *ibid*.

- **Argentinean Network of Municipalities Facing Climate Change (ANMFCC)**

It's a coordination organization that promotes local public policy on climate change. Through this model, local actions are organized, experiences are shared and results of the implemented programs are monitored, according to international agreements such as the Kyoto Protocol and IPCC recommendations (ANMFCC, 2014). The network intends to serve as a support platform for the local governments, by providing tools that enable them to achieve a sustainable development model *ibid*.

## 1.3 Case Studies

- **Energy Efficiency and Renewable Energies for the Design, Construction and Operation of Social Housing Pilot Project**

The project is organized by the national Sub-Ministry of Urban Development and Housing, the National Institute of Industrial Technology, the Ministry of Energy and the Provincial Institutes of Housing. It has a national reach and has the purpose of setting standard and technological guidelines for the design, construction and operation of low-income houses. The houses incorporate energy efficiency measures and renewable energy technologies, oriented to the reduction of energy demand and GHG emissions (SDUyV, 2012). The project applies currently available technical standards related to green building practices (energy efficiency and thermal conditioning) and then develops a housing pilot that monitors the results of the implemented policies and practices.

The pilot project follows a series of steps for the future development and replication of the model: 1) Design and construction of social housing pilot projects and setting up of community energy efficiency and renewable energy equipment. 2) Monitoring and evaluation. 3) Development of the national policy framework. 4) Strengthening of the regional capacity for the development and implementation of energy efficiency and renewable energy technologies

Some of the social and environmental expected benefits are: the direct and indirect reduction of GHG emissions on the annual production of social housing; improvement of the quality of life in marginalized urban zones; strengthening of the market of small and medium construction material and service producers; job creation and an opportunity to develop social housing projects under the NAMA (Nationally Appropriate Mitigation Action) scheme (SDUyV, 2012).

- **Sustainable Social Housing Project, 10 Houses for More Energy and the First Energy Efficient Neighborhood in Argentina**

In 2010, the neighborhood "Barrio la Perla", was selected to implement the social housing project, 10 Houses for More Energy. Public, private and academic organizations were involved in the project (the Municipal Administration, the National Sub-Ministry, the Housing, Sustainability and Energies Forum, the National Technology Institute, solar panel producers and the Habitat Study Center of the Architecture, Design and Urban Faculty of the University of Buenos Aires). The project adopts measures to achieve an improved energy performance on a sample of 10 houses, using the energy optimization methods proposed by IRAM (material, energy efficiency and construction technical standards).

The German Embassy in Buenos Aires, along with the private sector and the Municipality of Moreno are currently making progress on the development of the first energy efficient neighborhood of Argentina, aiming for a target of 100 energy efficient houses. Currently, this new phase adds 33 more houses to the original 10 of the pilot project, achieving energy efficient houses that save up to 50 % of the energy, improving the user's quality of life, budget and their environmental impact.





*Barrio la Perla, first energy-efficient neighborhood Argentina. Photo: Brian Funk (Source: argentinaindependent.com)*

- **70 Sustainable Houses for Manuelita Village Project**

The project began between 2011 and 2013 in Rosario, in the province of Santa Fe and was an initiative of a research group of the University of Rosario, with support from the United Nations Development Programme (Spain fund – UNDP) and promoted by the provincial Agency of Housing and Urbanism of Santa Fe (UNR, 2010). A house deficit for approximately 200,000 families was estimated in the province of Santa Fe and another 128,742 habitants live in irregular settlements, representing 14 % of the total homes in the province. It was also identified that a great number of neighborhoods are located on the urban periphery or in vacant land such as in the municipal train area. Furthermore, sanitary services are irregular, since in the case of electric energy and potable water, most installations are clandestine. Given this scenario, the project aims to tackle the regional housing deficit problem with an integral approach. The initial stages consider access to financing mechanisms and legal advice.

The building proposal consisted on the development of a low-cost and sustainable house, which incorporated new housing prototypes that include ecologic principles like material selection and energy efficiency. Three main elements define the housing design: environmental and low-cost material selection, energy efficiency measures for the construction and operation stages and the participation of the users in each and every step in order to create a strong feeling of involvement (UNR, 2010).

## 1.4 Future Actions

Argentina shows a remarkable progress in the establishment of legislation, standards and programs oriented to the implementation of energy efficiency measures in buildings.

They have also taken the first steps towards the incorporation of a more integral perspective of green building practices into national technical standards, by starting the normalization process of green building ISO systems, which is currently on a developing stage.

Besides energy efficiency, current green building practices are focused on promoting green roofs and terraces, material selection and water management. Also, the country faces a serious housing deficit, which they being to face with an integrative approach that incorporates renewable energy and energy efficiency principles into social housing pilot projects. Considering all of this, recommendations from a Top-Bottom perspective, for future actions to promote the green building industry are specified as follows:

- Establishment of national financial mechanisms and access to international funds, in order to finance the creation of evaluation and monitoring formal organizations that follow the progress of energy efficient and green building projects that have been implemented.
- Establish a clear and adequate institutional definition for the term "sustainable building", as the concept is commonly used on projects that might only include a few environmental measures besides energy efficiency.
- Incentivize the application of green building technical standards and voluntary certifications through public policies that grant attractive economic benefits to the investors, developers and users.
- Development and adaptation of national financing and credit programs for low-income families for the acquisition of energy efficient houses.
- Creation of institutional programs that besides incentivizing energy efficiency measures, promotes broader sustainability construction practices on residential and non-residential sectors.
- Establish and reinforce existing cooperation networks, focused on institutional capacity building for the development and implementation of green building public policies and programs.
- Development and transversal integration of a green building national strategy that considers a broader perspective of sustainable practices for buildings, such as site selection, water reuse, indoor air quality, connectivity, social wellbeing, among others.
- Development of a national green building code.



CL Studio House BAM! Architecture, sustainable housing located in Saladilla Province of Buenos Aires. Photo: Peter Urruti (Source: [revistaplot.com](http://revistaplot.com))



# 1.5 Lessons Learned

Given the fact that Argentina is one of the major energy consumers of Latin America, the government has greatly focused on the development and implementation of short, medium and long-term policies oriented to the efficient use of energy. In this context, the building sector provides support to the energy efficiency national strategies, by being a means to reduce energy demand. The most developed policies, technical standards and programs are related to the compulsory and voluntary implementation of energy efficiency measures, through solutions such as: thermal conditioning and insulation technical standards, Energy Efficiency Labels for Heating Systems for Buildings, efficient lighting replacement and renewable energies.

Other green building practices are implemented, such as solid waste and water management, green roofs and material selection. Given this context, and the fact that some institutional programs are defined as "sustainable building projects", even when they apply only a few green building practices, beside energy efficiency, it is important to create a clearer and more adequate institutional definition of what constitutes a sustainable building.

An important initiative for the implementation of green building techniques, from a broader perspective, is being done by IRAM that is in the process of developing a green building technical standard called Norma IRAM-ISO 15392, which is based on the international ISO system. This initiative is still on a development process, however it represents a great promise for the sustainable building sector in Argentina, as it will serve as baseline that local governments can adopt through its integration in provincial and municipal building codes.

Currently, one of the main priorities for the government is to face the existing quantitative and qualitative housing deficit, and they

are beginning to do it by integrating energy efficiency measures and sustainable building techniques to social housing projects. They have implemented pilot projects that include mandatory thermal conditioning and insulation technical standards to achieve energy efficiency in low-income homes. With the aim of improving and replicating the model of the pilot projects, they use the following methodology:

- 1) Design and construction of social housing pilot projects and setting up of community energy efficiency and renewable energy equipment.
- 2) Monitoring and evaluation.
- 3) Development of the national policy framework.
- 4) Strengthening of the regional capacity for the development and implementation of energy efficiency and renewable energy technologies

Furthermore, the case study 10 Houses for More Energy in the neighborhood la Perla is another initiative by the government and key actors of the sector, to implement energy efficiency measures on low-income houses. The project began with 10 houses and has extended its reach, setting the target of 100 energy efficient houses, with the purpose of being the first energy efficient neighborhood of Argentina. Finally, the project 70 Sustainable Houses for Manuelita Village, besides including techniques to achieve energy efficiency on the construction and operation stages, integrate material selection and community participation of the project, in order to achieve a strong feeling of ownership.

Future recommendations include the establishment of mechanisms for the creation of formal organizations that monitor and evaluate the results of projects that have been implemented.

It is common that projects may lack the funding for the monitoring phase, which is a crucial part to determine results of energy and CO2 reductions.

Also, the clear and adequate definition of the term "Sustainable Building" could facilitate the categorization of projects and establish parameters for a better public understanding. Even though Argentina is at the first stages of implementing energy efficiency measures into residential and non-residential buildings, one recommendation is the explicit integration of sustainable building into the public policy agenda.

Developing a green building national strategy can catalyze bottom-up initiatives and incentivize the use of voluntary international certification tools and prepares the market for the implementation of the green building technical standard. Finally, another future recommendation is that the government can begin implementing low cost structural incentives, such as density bonuses or expedited permitting processes that have low or no cost for the governments and encourage developers to build green.



# Brazil





## 2.1 Context

According to the Census of 2011, the Federative Republic of Brazil has a population of 192,376,496 inhabitants. It is the largest economy in Latin America and it's considered the sixth largest economy of the world. With an extension of 8,514,876.6 square kilometers, it is considered the largest country in South America. It is divided in 26 states, 5,565 municipalities and its federal district, Brasilia, also the country's capital and where the executive, legislative and judicial powers are located. It is home of an extensive variety of flora and fauna, and of one third of the total tropical forests of the planet (SCN, 2010).

Brazil is part of the non-annex 1 countries of the UNFCCC, that among other agreements, acquires the one established on the 12th article of the UNFCCC, regarding the periodic update and publishing of the national inventories of anthropogenic emissions of GHG and the national actions and strategies for climate change adaptation and mitigation. Furthermore, through the Law No. 12.1287/2009 and the decree No. 7390/2010, the State committed to the voluntary reduction of 36.6% to 38.9% of the projected emissions for the year 2020 (Ley a, 2009).

Brazil is the tenth largest global energy consumer and Latin America's number one electric energy consumer (IPEEC, 2012). According to the Second National Communication of 2010, it is estimated that in the year 2005, 77 % of the GHG emissions were caused by the land use and forestry sector and 19 % of the GHG emissions were produced by the energy sector, which is comprised of transport, industry and energy transformation activities.

From the year 1997 to 2012, Brazil achieved an important progress on the production of clean energy by generating 76.9% of their domestic electric energy through hydraulic power (BEN, 2012). Also, from the year 2005 to 2010, Brazil achieved the reduction of approximately 39 % of their GHG emissions, through their National Climate Change Strategy, which was mainly focused on deforestation reduction, achieving these changes without compromising economic growth (Tollefson, 2013).

However, despite the emphasis on the use of hydroelectric energy, between the year 2005 and 2010 there has been an increment of 21.4 % of the GHG emissions produced by the energy sector, due to an increase in the use of fossil fuels for electric energy use (Tollefson, 2013). The National Energy Balance of 2012 records that the electric energy demand for the industrial sector is 35.4 %, residential use consumes 19.8 %, the public sector uses 6.7 % and the commercial sector consumes 13.5 % *ibid.*

Parallel to the increase of emissions derived from the energy sector, in 2010, the construction industry grew an 11.6 % due to the implementation of the Growth Acceleration Plans (GAP), which are focused on the energy, transport and housing sectors, and were funded from investments on oil and gas extraction and production (OPNSP, 2012). It is estimated that emissions derived from the energy sector will continue their growth trend at an annual rate of 2 %, which is correlated to the estimated economic growth rate of 3 %, projected from 2013 to 2016 (Viola, 2013).

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<sup>2</sup> Developing countries are known as non-annex I countries and do not have quantitative emission reduction commitments, nevertheless they do share the same commitments as all the parts of the convention, such as action planning and implementing and education and awareness activities

The construction sector holds a strategic relationship with the economic context of the country due to its correlation with macroeconomic variables and growth indicators (when the gross domestic product presents a positive growth, the construction industry grows pronouncedly). Also, due to all the sectors that compose the building productive chain such as industrial activities associated with the production of raw materials, services and building equipment (OPNSP, 2012).

It is important to acknowledge that 30 million people are still facing poverty issues, which means that the government's priority agenda is focused on economic development, public health improvement, fighting hunger and ensuring adequate living conditions, among others (SCN, 2010). Between 2003 and 2012 the Brazilian government built almost 2 million houses, nevertheless there is still a house deficit of 5.8 million units (OPNSP, 2012). Despite the sustained growth of the last years (2.6 % of GDP increment on 2006 and 2.7 % on 2011) (Banco Mundial, 2014), there is an increasing population in the country whose basic needs still have to be met, where the creation of infrastructure is incipient.

With the purpose of covering the existing housing deficit, the government projected the construction of 2 million new social houses between the years 2011 and 2014 and it is estimated that from 2010 to 2022, the construction of 23.5 million new houses will be needed (Caixa, 2011; CBIC, 2012).

Brazil is currently going through a key period of time facing the upcoming international sport events. The challenges derived from the football world cup on 2014 and the Olympics on 2016 have been approached as opportunities to incentivize changes in the construction sector and the economic and social development strategies. A budget of approximately 13.6 billion USD is estimated for construction projects, besides the modernization of airports and port construction (ECICII, 2012). Furthermore, the national Tourism Ministry has set the objective of turning Brazil into one of the most attractive tourist destinations worldwide by the year 2022 *ibid*.

However, Brazil currently follows the Latin American urbanization tendency, where cities tend to disperse along large territories, due to low costs of peripheral land (ONU, 2012). As a result, this poses great challenges in terms of sustainability and management, as the loss of density signifies an increase on infrastructure costs and maintenance *ibid*. The Brazilian context suggests that the construction sector presents great challenges and opportunities because it is a key sector for economic development and social welfare improvement, but at the same time, it poses potential tensions with sustainable development principles, in part due to the urban development practices that have been implemented.



*Cover: Concepts. Landscape and music school developed as a single building in São Paulo. (Source: holcimfoundation.org)*

*On this page: Children playing in a neighborhood of the Favelas. (Source: agrega.educacion.es /)*

## 2.2 Baseline

The Ministry of Environment (ME) implements Agenda 21 as a planning instrument to achieve more sustainable communities and recognizes sustainable building as an integral solution to approach diverse social and environmental problems. It recognizes green buildings as a means to achieve the efficient use of energy, air and life quality improvement, reduction of urban waste, reduction of high environmental impact materials, material reuse, use of renewable energies, flora and fauna conservation and a strategy for social development, among others (MMA, 2014).

On December 2008, the president signed the National Climate Change Plan (NCCP). From the NCCP derives the National Energy Efficiency Strategy (NEES), which establishes a reduction goal of energy demand of 10 % for the year 2030. To achieve this, it incorporates measures such as electric appliance replacement and improvement of energy efficiency in the industrial, transport and building sectors (IPEEC, 2012). In alignment with the law N ° 10.295/01 of Energy Efficiency, the program PROCEL Edifica focuses on promoting energy efficiency on buildings and has been applied voluntarily since 2007 (the intent is for the program to be compulsory in the future).

The Brazilian case stands out from other countries in the region for the implementation of a successful synergy between laws, decrees, programs and incentives, and the use of local and international voluntary green building certification tools, as a strategy to promote sustainable building projects in the country. Considering that each municipality sets up their environmental and resource use policies and construction codes, it is important to highlight that both the national and subnational levels have accomplished a remarkable progress in the development of legislation and programs that incentivize green building from a holistic perspective and not only from an energy efficiency point of view.

Since 2007 the green building industry in Brazil has grown by leaps and bounds, by consequence the market transformation process has been accelerated. In the year 2013, Brazil was the fourth country in the world in the number of LEED registered projects (USGBC, 2013). Even though LEED is the certification tool with more certified projects in the country, other local certification tools are emerging with great success in the Brazilian market.

AQUA is a construction process that seeks high environmental quality and consists on carrying out the project supervision of a building in all of its stages (program, design, construction and operation). It is based on the French methodology, High Environmental Quality (HEQ) and has been adapted to the Brazilian context, implementing its first version on the year 2010, on a social housing prototype located in Sao Paulo. The system has the advantage that local agents certify the building projects, which has incremented its market demand (TWBG, 2011).



Selo AZUL da CAIXA is defined by the CAIXA Econômica Federal as the first system used for the classification of sustainable projects in Brazil, developed for the social housing sector. It establishes the following objectives: to promote the rational use of natural resources in the social housing sector; reduce maintenance costs of construction projects and monthly costs for users; Finally, to rise awareness among developers and users about the benefits of green building (Shoji et al., 2013).

The certification consists on three levels of classification and has six categories that buildings have to comply with:

- 1) Urban quality;
- 2) thermal comfort;

- 3) energy efficiency;
- 4) materials and resources
- 5) water efficiency and
- 6) social practices *ibid*.

Recently, Brazil Green Building Council developed the Referencial GBC Brazil Casa, a certification tool designed especially for the residential sector. The tool has been developed using several rating tools such as, LEED home, Selo Azul da CAIXA, la Dorada and PROCEL Edifica, among others.



Project Area Paraisópolis sustainable housing. This project was given the first Selo Caixa Casa Azul gold level in 2011 (Source: caixa.gov.br).

## 2.2.1 Laws, decrees and standards

- The Law 10.295 of 2001, of Energy Efficiency mandates the setting up of the maximum levels for energy consumption or the minimum levels of energy efficiency to accomplish a rational use of energy resources, conservation and the protection of the environment. In its fourth article, the law establishes the mandatory development of mechanisms and regulations that set up the required minimum performance of buildings (Ley 10.295, 2001).
- The Decree No. 4.059, that regulates the 10.295 Law of energy efficiency establishes the maximum levels of energy consumption or the minimum levels of energy efficiency, and through the article 15th it determines the following: I) The adoption of energy efficiency evaluation procedures for buildings. II) Certifications of compliance for new and existing buildings that comply with technical requirements of energy efficiency (Decreto No. 4.059, 2001).
- The Ministry of Planning presented the presidential Decree No 7746/2012, which rules the third article of the 8.666 Law, concerning institutional rules for bidding and public contracts. The Decree intends to order the use of sustainability criteria for the acquisition of public goods, including building contracts. To do so, it establishes sustainability as one of the main criteria to consider among the technical specifications of the bidding processes, for the acquisition of goods, services and construction projects.

For the building sector, the decree proposes a set of requirements that guarantee a sustainable approach for all of the building stages; it includes criteria for the reduction of energy use, water consumption and the implementation of technologies and low environmental impact materials. The decree also establishes the possibility to consider voluntary certifications as guiding and compliance tools that can assure that public authorities will acquire an energy efficient and low environment impact service, product or project (Decreto 7.746, 2012). Some result of this initiative are the LEED Silver certification of the central office building of the Ministry of Planning and the LEED project registration of the premises of the Itu local administration. Similarly, the World Cup and Olympic stadiums aim to attain with sustainability certifications.

There are currently a diverse number of green building policy initiatives that have been implemented in different municipalities of the country. At the subnational level, each municipality is responsible for instituting a local construction code, and several local governments are promoting green building practices by establishing green property taxes.

- An example of this incentive has been implemented in the city of Guarulhos, in the state of Sao Paulo, where according to the municipal Law No. 6.793/2010 buildings that implement one or two sustainable practices can reduce up to 20 % of the total property tax for a period of 5 years. The sustainable practices that can be implemented are: rain water storage, water treatment and reuse, solar heating systems, low environmental impact materials for the building stage, green roofs, waste recycling and planting of at least one tree in the property (IPTU, 2014).



- On the other hand, since 2012 Rio de Janeiro authorities have been promoting green building practices through the use of the Qualiverde certification, which is ordered by the Decree No. 3.5745/2012 and offers administrative fiscal incentives. The Qualiverde certification is optional and it's applicable to new and existing buildings for residential, commercial and institutional use. The certification will be obtained by the compliance of green building practices established on Annex I of the 3.5745/2012 decree.

One of the most important projects, still in a developing stage, is the Law Project 1415/2012, which is being approved by the Municipal Chamber of Deputies and intends to offer more fiscal incentives and administrative benefits for the projects that obtain the Qualiverde certification (Ley 1415, 2012). The law proposes the following incentives:

- Property tax – During the construction stage, a discount of 50 % on the property tax will be granted to construction projects that comply with the Qualiverde certification (70 % compliance), and if the project achieves the Total Qualiverde certification (100 % compliance) the payment is completely cancelled. During the operation stage of the building, discounts of 10 % to 20 % can be granted according to the certification the building achieved.
- Service Tax – The country applies a tax of 3 % to the total value of contracted services for house construction projects. If the developer receives the Qualification classification, the tax will reduce to 1.5 % or 0.5 % if the project obtains the Qualiverde Total classification.
- Tax over property sale – This tax refers to the burden that applies when a property is sold. Its value is 4 % of the total sale price, nevertheless, if the owner attains the Qualiverde certification, the applicable tax will be of 2 % of the total sale price and with a Qualiverde Total certification the tax is completely cancelled.

Source: rio.rj.gov.br)



### Energy Efficiency

- **National Program of Energy Efficiency for Buildings (PROCEL Edifica)**

PROCEL Edifica was implemented on the year 2003 by ELECTROBRAS/PROCEL in conjunction with the Ministry of Mines and Energy, the Ministry of Cities, universities, research centers, other governmental entities and the civil society from the construction sector. The program promotes the rational use of energy in buildings from the construction stage. With the development of the program actions were extended to promote conservation and the efficient use natural resources (water, lighting, ventilation, etc.) in buildings and waste and environmental impact reduction.

For the development and promotion of these concepts the program works through 6 activity lines: capacity building, technology, promotion, regulation, energy efficiency in the housing sector and land planning (PROCEL a, 2014).

The program sets the following objectives (PROCEL b, 2014):

- Investment in technical and professional capacity building and encouragement for research and the development of adequate solutions for the Brazilian context, which support the reduction of building energy consumption.



National Stadium in Brasilia, renovated and fully sustainable. (Source: aboutbrasil.com)



- To attract a greater number of interest groups from different construction sectors that can contribute on finding solutions to achieve greater energy efficiency on buildings.
- Promote concepts and practices of bioclimatic architecture by incorporating topics such as environmental comfort and energy efficiency into architecture and engineering courses, in order to create a new generation of professionals committed with the sustainable development of the country.
- Promote energy efficiency and environmental quality concepts among architects, civil engineers and other professionals involved in the urban planning.
- To support the implementation of the building regulation established by the Energy Efficiency Law (10.295/2001) and provide technical orientation to adapt the law to the current construction codes and general urban planning.

The program has a labeling system that applies for new constructions and existing buildings under the categories of commercial, public and residential sectors. The aspects that are evaluated are: thermal envelope, lighting and air conditioning systems. To the year 2012, the program has achieved the labeling of 1,120 residential buildings and 64 commercial buildings, the training of 2,891 professionals, the creation of 12 laboratories, 27 professionals trained as inspectors and 2 database and energy simulation software (MME, 2012).

## Sustainable building

### • Minha Casa, Minha Vida

As a means to face the existing housing deficit, the federal government subsidized the program as an economic stimulus for the construction of approximately 3 million low-income houses for the year 2014. In the first phase of the program, one million houses were built and included subsidies for the voluntary installation of solar heating systems, with the objective of reducing carbon emissions and benefiting the users with economic savings. For the second phase, 2 million houses will be built and the incorporation of solar heating systems is mandatory (TWBG, 2011).

The program allows municipalities to integrate additional requirements into the housing projects. In this context, the municipality of Rio de Janeiro published voluntary guidelines for sustainable design and construction that include recommendations on the following categories: rain water harvesting, use of non-toxic materials, use of low energy consumption materials, use of materials with recycled content, use of efficient construction materials that reduce the amount of waste, recycling facilities for the users, natural site preservation, passive design, use of local materials, among others (TWBG 2011).

### • Morar Carioca

This social housing program, also known as municipal plan for the integration of informal settlements is developed due to the fact that 22 % of the population in Rio de Janeiro lives on informal settlements or favelas that lack basic services or construction standards. This results in water pollution, land degradation, methane emissions from waste and rubbish and health problems. The program has the objective of regularizing 232,000 homes to the year 2020, through solutions such as integral development, basic service provision, sustainable urban planning, construction improvement and the regularization of land property (CCLA, 2013).

In the case of two favelas, Babilonia and Chapéu Mangueria, the main focus was the reduction of carbon emissions through sustainable practices such as the use of LED lighting and waste sorting and collection. In Babilonia, the government of Rio built 16 green houses and paved the area to provide the community with better accessibility. Up to now, the government has achieved the urbanization of 68 favelas, which have provided direct benefits to over 65,000 homes (CCLA, 2013).

- **Selo Azul CAIXA**

The program aims to incentivize social housing projects that contribute to the reduction of environmental impacts through criteria related to urban quality, thermal comfort and design, energy efficiency, conservation of material resources, water management and social practices (CAIXA, 2010). It was developed by CAIXA Econômica Federal, a public financial institution that offers financial incentives for the acquisition of houses, specifically for the acquisition of a first house. On 2009, more than 47 billion of Brazilian Reals were financed, representing 71 % of the total real estate credit market and bringing benefits to approximately 897,000 families *ibid*.

Besides the financing program to acquire homes, CAIXA has developed an evaluation tool that certifies the level of sustainability of housing units (levels: gold, silver and bronze). In this sense, social housing developers can consider the criteria proposed in the evaluation tool, which includes elements such as social quality of the house, energy efficiency and the environmental impact of the building, among others. The Selo Azul da CAIXA program intends to promote the rational use of natural resources, reduce maintenance costs and to raise awareness among the developers and users about the importance and benefits of sustainable buildings.

- **Qualiverde**

This incentive program has turned Rio de Janeiro into the country's leading city in the development of more and better fiscal incentives to promote green buildings. The program is mainly based on providing fiscal and construction incentives such as reductions on property and construction taxes, as well as tax exemptions and special considerations in the local construction code (Decreto 35745, 2012).

The Qualiverde certification is flexible and adaptable to the particular conditions of each project, providing the possibility to choose among a diverse number of sustainable practices, but having to comply with at least 70 % of the criteria established in the mandatory decree. In this sense, a Qualiverde certification (completion of 70 % of the criteria) or a Qualiverde Total certification (completion of 100 % of the criteria) can be obtained. The decree includes diverse practices and construction techniques related to water management, energy efficiency and the thermal performance of the project.

## 2.2.3 Research Organizations

- **Brazilian Council of Sustainable Construction (CBCS)**

The CBCS promotes the use of the Modular Life Cycle Assessment and has the objective of creating a platform that orients consumers in their decision-making process by providing a platform that contains sustainability indicators of the different construction materials, products and components. This main objective of this initiative is to measure the following aspects: energy, water and raw material consumption, waste and CO<sub>2</sub> emissions.

- **Green Building Council Brasil (GBC Brasil)**

Brazil GBC also stands out for their role in the gathering of more than 200 voluntary professionals for the development of the certification tool for houses, Referencial GBC Brazil Casa. The organization currently works on nine pilot projects (case studies) to analyze the technical and economic viability of the certification tool. Additionally, GBC Brazil, along with the Green Building Certification Institute, stimulate the creation of local technical standards as an alternative route of completion.

- **Other Research organizations**

It is also important to mention efforts done by civil organizations, private companies and governmental agencies such as INMETRO (National Institute of Meteorology, Quality and Technology) to develop product certifications for green buildings, such as CERTIFICASOL (certification for water heating equipment). Finally, ELECTROBRAS, through the development of the PROCEL Edifica certification to promote energy efficiency in buildings, is another leading organization that focuses on research, professional capacity building and the promotion and development of technical standards in the country.

## 2.3 Case Studies

- **Housing Complex in Paraisópolis**

A successful case of the implementation of the Selo Azul da CAIXA certification is a housing complex of 171 units of 50 sq. m., located in Paraisópolis, a low-income neighborhood of Sao Paulo that concentrates a population of 60,000 people. Concepts such as urban quality, thermal comfort, energy efficiency, use of low environmental impact materials, efficient water systems and social practices were the baseline for the development of the project. The project established as a priority to conserve the original landscape, this way they were able to accomplish an effective use of natural resources, environmental comfort of the residents, access to public transport and basic services and positive social practices were promoted. The project was awarded second place in the Holcim Awards of 2012 and was certified with the gold category due to the completion of 39 out of 46 criteria of the Selo Azul da CAIXA methodology (CAIXA, 2014).

User's satisfaction has been confirmed through interviews that have served as testimonies of the indoor comfort of the apartments. Additionally, water and energy savings had a positive impact for the user's economy, even more considering that the cost of the construction incremented only by 1 % in respect to the cost of a conventional building (Shoii, 2013).



*Paraisópolis in Sao Paulo (Source: domisweb.it)*



- **Green District**

The development of an area destined for the establishment of research and development companies that consider sustainability practices was planned on the neighborhood of Ilha do Bom o Ilha do Fundão, inside the Guanabara Bay, in the state of Rio de Janeiro. The construction code of this new area forces companies to comply with a sustainable building certification. It also requires the installation of a sewage treatment plant for all the wastewater. Additionally, the government has invested in the installation of recycled pavement and in energy efficient street lighting.

A successful example of a sustainable building project inside the Green District is the Research Center of Petrobras. About 200 specialists of diverse disciplines collaborated in the project to achieve the maximum level of energy efficiency and the lowest environmental impact. Among some of the physical characteristics of the building are design that incorporates natural light and ventilation, rainwater collection and management system and the water treatment system for all of the wastewater, with the purpose of returning it clean into the bay. .



First green district of Brazil in Rio de Janeiro. (Source: [ciclovivo.com.br](http://ciclovivo.com.br))



## 2.4 Future Actions

As it was previously mentioned, an important initiative, still in a developing stage is the Law Project 1415/2012 that intends to offer more fiscal incentives and administrative benefits to the building projects that obtain a Qualiverde certification. Considering the country's general context and the previously presented initiatives, recommendations for future actions and policy-making, from a top-bottom perspective, are proposed:

- Development of a green building national strategy that integrates initiatives that are currently in place and articulates a long-term vision for the sustainable building sector, with special focus on the social housing sector, which is projected to grow massively.
- Establishment of national financial mechanisms and access to international funds, in order to finance the creation of evaluation and monitoring organizations that follow the progress of energy efficient and green building projects that have been implemented.
- To create an inter-ministerial committee that takes responsibility for pushing the national green building agenda forward and integrates other strategic governmental ministries.
- Plan for sustainable social housing projects that consider a vertical growth, through integral, efficient and low-environmental impact buildings that increase demographic density and avoid the dispersion of cities.
- To extend the commercial and residential energy efficiency label system to the social housing sector.
- Develop public policies that incentivize and regulate the implementation of local voluntary certification tools (AQUA, Selo Azul da CAIXA, Referencial GBC Brazil Casa, etc) in the commercial, residential and social housing sectors.
- To strengthen institutional capacities for the development and implementation of green building public policies.

## 2.5 Lessons Learned

Brazil's public policies, local certification tools and implemented projects incorporate a more holistic approach of green building practices that go beyond the inclusion of energy efficiency and water management measures. The country stands out from other Latin American countries due to the implementation of a successful synergy between laws, decrees, programs and incentives, and the use of local and international voluntary green building certification tools, as a strategy to promote green building projects in the country.

Brazil is the fourth country in the world in the number of LEED certified projects and even though currently LEED is the certification tool with more registered projects in the country, locally adapted certification tools have been developed in the last years, and they are increasingly becoming more popular and successful. AQUA, Selo Azul da CAIXA, Qualiverde certification, and Referente GBC Brasil are examples of local adapted certifications for the commercial, residential and social housing sectors.

The national government faces two major challenges; to cover the existing housing deficit of approximately 5.8 million houses and poverty alleviation. From the construction sector, these challenges are being faced with a long-term vision that incorporates sustainability practices in existing and new constructions.

Institutional programs such as Selo Azul da CAIXA, Morar Carioca and Minha Casa, Minha Vida are examples of initiatives that respond to these challenges, by facilitating financial savings for home owners and incorporating elements of environmental care, energy efficiency and a more holistic view of sustainable building practices.

Some of these programs allow the incorporation of green building practices such as rainwater collection and use systems, use of non-toxic materials, materials with low energy consumption, materials with recycled content, efficient materials that reduce waste in the construction process, recycling facilities for users, natural site preservation, passive architecture design and the use of local materials, among other practices. This shows an improved progress of the concept of sustainable building in the country.

Brazil has established the national decree No. N.7746/2012 of Public Acquisitions that compels the incorporation of sustainable principles in bidding processes for public contracts, which include contracts for the construction of public buildings. The decree establishes that all public building should be constructed sustainably. This initiative has resulted in the LEED certification of the premises of the Ministry of Planning and the registration for the LEED certification of the Municipal Offices of Itu. Such initiatives now set a precedent and standard for future public buildings.

At the subnational level, each municipality is responsible for instituting a local construction code, and several local governments are promoting green building practices by establishing green property taxes. One of the most relevant initiatives in this regard is the Qualiverde Rating System, implemented in Sao Paulo by the mandate of a local decree, which offers fiscal incentives in the form of reduction to property taxes to construction projects that comply with the specifications of the rating system. The local government is still in the process of refining the policy framework and diverse incentives for the application of the Qualiverde Rating System.

The current context shows an increase in the GHG emissions derived from the energy sector, which was caused by economic growth, extraction of fossil fuels and growth in the construction sector, among others. In this sense, the construction sector is a key supporting element of the National Energy Efficiency Strategy, which has established a carbon emission reduction goal of 36.6 % to 38.9 % for the year 2020. The Decree No. 4.059 that regulates the Law No. 10.295 of energy efficiency establishes the maximum limits of energy consumption or the minimum levels of energy efficiency for buildings. It also establishes regulations about the adoption of energy efficiency evaluation procedures for buildings and the certification of compliance energy efficiency technical requirements for new and existing buildings.

The program PROCEL promotes the rational use of energy in buildings from the construction stage and has a labeling system that applies for new and existing buildings in the commercial, public and residential sectors. The evaluated aspects are: thermal envelope, efficient lighting and air conditioning systems. To the year 2012, the program has achieved the labeling of 1,120 residential buildings and 64 commercial buildings, the training of 1,891 professionals, the creation of 12 laboratories, 27 professionals trained as inspectors and 2 data base and energy simulation software (MME, 2012).

It is also important to highlight the key moment that Brazil is currently going through by hosting the World Cup in 2014 and the Olympic games in 2016. The government's and event committee's vision of establishing sustainability parameters for the new infrastructure has an intrinsic, long-term vision, which could be an important catalyst for the development and growth of the green building sector in the country.

Finally, some recommendations for future policy and decision-making are: to integrate currently implemented green building initiatives in a national sustainable building strategy that also articulates a long-term vision that guides the country's actions to a more sustainable construction industry. To establish an interministerial committee responsible for pushing the national green building agenda and that integrates other strategic government agencies.

The establishment of financial mechanisms that fund the evaluation and monitoring of implemented projects, to ensure their performance and their actual achieved savings and benefits.

By integrating the social housing sector into the energy efficient labeling system, there would be more certainty of the energy performance in housing developments. Finally, the establishment of incentives for the implementation of voluntary certifications, such as the incentives established for the Qualiverde certification could be an important step for the green building market in the country.



*Christ the Redeemer in Rio de Janeiro. Emblematic point in Brazil. (Source: turismocuatro.cl)*



# Colombia





## 3.1 Context

On 2012, the Republic of Colombia had a population of 47.7 million people (Banco Mundial, 2014). It's a democratic and decentralized republic, with territorial independence, divided into 32 departments, which are sub divided into approximately 1,100 municipalities (IGAC, 2014). The capital is Bogota, the most populated city and also the political, financial, industrial and commercial center of Colombia (SCN, 2010).

Colombia is ascribed to the UNFCCC, through the Law No. 164 of 1994, as a non-annex 1 country, and has signed the Kyoto Protocol and approved it through the Law No. 629 of 2000 (SCN, 2010). Due to possible risks and impacts caused in the country by climate change effects, such as extreme weather, Colombia has recently incorporated sustainability concepts to its national environmental policy. These changes are articulated through the National Development Plan (NDP) of 2010-2014, where strategies to ensure a sustainable growth are proposed (PND, 2010). The National Climate Change Adaptation Plan (still under development) is a strategic action plan that emerges from the NDP as an integral approach to the implementation of climate change adaptation and mitigation measures (PNACC, 2012).

During the 15<sup>th</sup> Conference of the Parties (COP) held in Copenhagen on 2009, Colombia presented before the UNFCCC, voluntary agreements for emission reduction, which include: the guarantee that by 2020, at least 77 % of the installed energy capacity will come from renewable sources; to reduce deforestation to 0 % by 2020, and to stimulate the production of biofuels, such as ethanol and biodiesel, with the objective of covering at least 20 % of the total energy production by 2020 (PNUMA, 2010). Clean Development Mechanisms (CDM) are considered one of the most relevant means to develop mitigation projects in the country and it was estimated that a reduction of 54.8 Mt CO<sub>2</sub> can be achieved by implementing CDM projects in the energy, forest, industrial, transport and waste sectors *ibid*.

According to the Second National Communication of 2010, in 2005 Colombia emitted 0.37 % of the global GHG emissions, and occupied the fourth place among Latin American Countries. The GHG emission inventory of 2004 was distributed as follows: 36.6 % energy, 38.1 % agriculture, 14.5 % land use and forestry, 5.7 % waste and 5.1 % industrial processes (SCN, 2010).

For the past decade, energy consumption in the country incremented at an annual rate of 2.9 %; it was estimated that between 2013 and 2014, energy demand would increase between 3.9% and 4.4 %, and an average annual growth rate of energy consumption of 3.9 % was estimated for the period 2012-2020 (MME, 2013). On 2010, energy demand of building-related sectors was distributed as follows: 21.2 % Residential, 1.4 % building, 5.4 % Commercial and public and 28.3 % industrial (UPME, 2010).

In Colombia's current scenario, the building sector represents one of the main economic drivers, having achieved growth levels in the order of 7.9 % to 10 % in the last years (Bonilla et al., 2013). According to the Colombian Construction Chamber, 50 % of the construction sector corresponds to buildings and the other 50 % corresponds to public infrastructure projects. Furthermore, it was estimated that on 2013, the building sector grew 16.9 % in respect to the GDP (CC, 2013).

The NDP 2010-2014 articulates a national development vision for 2019 that establishes that building "friendly houses and cities is a fundamental strategy for poverty alleviation, sustainable economic growth, wealth generation and a means to overcome the public losses occurred by the climate impacts of the winter 2010-2011, with a greater regional equilibrium" (PND, 2010, pg. 152). It is acknowledged that on 2009, Colombia faced a national housing deficit of 13 %, or 1,200,000 houses, and that a great number of houses (about 15 %) are located on informal settlements that do not have access to basic services or adequate sanitation (PND, 2010). In this context, one of the main objectives established on the NDP, for the development of friendly houses and cities, is to incorporate environmental, urban and risk management sustainable parameters to guide city developments, along with the implementation of other objectives aligned with the Millennium Development Goals *ibid*.

The National Planning Department posed the following conditions regarding the current situation of the green building industry: In general terms, current housing and building practices do not consider minimum standards of sustainability, such as energy efficiency and reuse technologies; there is a low production of eco-technologies in the local market; weak national regulations to promote the adoption of sustainable policies in the building sector, and finally, there is no available information or instruments to define a national sustainable social housing policy and there is a lack of incentives to promote the inclusion of eco-technologies in construction projects (DNP, 2013).

Colombia, like other Latin American countries, faces great challenges related to social and economic development and the inclusion of sustainability principles into national development strategies. Due to the country's vulnerability to the impacts of climate change, its central strategy to face the phenomenon is oriented towards adaptation measures. In this sense, besides considering green building as a solution for GHG emission mitigation, the efficient use of energy and natural resources and as an economic engine, it should also align with adaptation to climate change strategies.

## 3.2 Baseline

In the past years, sustainability has acquired greater relevance in the national public policy agenda. An example of this is the Law 145 of 2011 that regulates the implementation of the NDP 2010-2014, and that mandates the incorporation of sustainable development principles and adaptation to climate change strategies as transversal and priority strategies of the NDP (Ley 1450, 2011).

The NDP 2010-2014 contemplates a national sustainable growth agenda that includes considerations for climate change adaptation and the development of low-carbon cities. The National Climate Change Adaptation Plan (NCCAP) and the Colombian Strategy for Low-Carbon Development (CSLCD), both still in development stage, are strategies that intend

to implement climate change adaptation and mitigation measures, and acknowledge the key role that energy efficiency solutions and sustainable building practices play, to achieve the established goals.

The NDP also proposes the integration of environmental, urban and risk management sustainable parameters for city development. Such parameters include: densification, urban renovation and controlled expansion; Integral improvement of neighborhoods; the provision of sustainable social housing; efficient and alternative transport systems; efficient use of energy; access to basic sanitary services and water, and sustainable building (PND, 2010).



*Residential Sayab in Cali, Colombia, received the Gold Medal to environmental responsibility. By architect Luis de Garrido. (Photo: Luis de Garrido, Source: twenergy.com)*



Some of the main projects, currently in a developing phase, to create green building norms, standards and codes are: Energy and Water Efficiency Guideline for Buildings, Colombian Environmental Seal for Green Buildings, Seals of the National Saving Fund and the Technical Guideline of Energy Efficiency for Low-Income Housing. The characteristics of these policy instruments are described in the following paragraphs.

The Ministry of Housing, City and Territory and the Ministry Sustainable Development and Environment promote the development of the Energy and Water Efficiency Guideline for Buildings. The aim of this instrument is to provide a reference guide regarding the most efficient technologies and strategies for energy and water saving, adapted to the Colombian context.

The guideline considers different climate variations according to the zone, building characteristics and the market's context, in order to promote the efficient use of energy and water in buildings. This initiative conducted a preliminary building categorization to gathered construction patterns, then created a framework that was used as a baseline to individually model diverse strategies on different types of buildings, in order to build a classification matrix based on a cost-efficiency relationship.

The Colombian Environmental Seal for Green Buildings is a voluntary environmental label that provides users with verifiable information about the sustainable characteristics of buildings (CCCS, 2014). Progress in the development of the seal has been made on the following topics: environmental aspects and impacts, risks, sites, water efficiency and savings and impacts during the construction stage.

Topics that have recently been concluded are: energy efficiency, waste management, indoor air quality, durability and plagues. The topic of materials is yet to be developed. In an initial stage, the seal will focus on non-residential buildings; however, there are future plans to continue with a version of the seal focused on the housing sector *ibid*.

The Seals of the National Saving Fund incentivize the construction of more sustainable housing developments through five colored seals that represent the following: blue seal – social aspects, green seal – environmental aspects, gray seal – technical aspects, orange seal – digital homes and white seal – reliability (USAID, 2013).

The aim of the seals is to help build a better society and improve user's quality of life, by considering four key factors for future urban development: bioclimatic urbanism and alternative systems for water and energy efficiency; optimal and sustainable urban density over net available land for urbanization; essential urban infrastructure at optimal distances and bioclimatic and sustainable social housing developments *ibid*.

The Technical Guideline of Energy Efficiency for Low-Income Housing sets the technical parameters for the efficient and rational use of energy, to be applied on the design and construction of low-income houses that receive a national subsidy (USAID, 2013).

Regarding the use of voluntary certifications, the LEED rating tool has been incorporated to the Colombian market with an increasing acceptance. Up to April 2013, there were 127 registered projects from which 32 have already been certified with a basic, silver, gold or platinum certification (USGBC, 2014).



## 3.2.1 Policies, Laws, decrees and standards

- The Law (No. 697/2001) to promote energy efficiency and renewable energies, and its regulatory Decree (No. 3683), declare the efficient use of energy as a national priority and establish programs, policies and guidelines that conform the regulatory framework for the design and implementation of measures to promote energy efficiency (UPME, 2010). Such is the case of PROURE, or the National Program for the Rational and Efficient Use of Energy and Renewable Energies, which seeks to set energy efficiency parameters for the design, construction and use of energy in houses (MME, 2009).

Despite the initial progress made on energy efficiency policy-making, there are still no technical standards available for building design and strategies oriented to the implementation of minimum levels of energy efficiency for the operation stage of buildings (MME, 2011). However, the government is currently working on setting up the funding mechanisms for the development of these standards *ibid*. There are a number of energy efficiency technical standards, all of them mainly focused on energy consumption for appliances and equipment, such as light bulbs, solar energy systems, heaters, refrigerators and air conditioning equipment (CIDET, 2012).

Other recent energy efficiency initiatives include triangular cooperation agreements for the development of policies and programs that address energy efficiency in buildings. Such is the case of the Triangular Cooperation Agreement, Mexico-Colombia-Germany that served as a platform to share experiences such as Mexico's successful social housing program Hipoteca Verde (Green Mortgage), climate zoning, certifying organizations, methodologies to measure savings and the unique registry of sustainable housing (DNP, 2013).

- The Law Project No. 119 of 2012 (not yet approved) proposes general parameters to grant tributary benefits and other types of incentives to promote sustainable buildings. To do so, the law grants local authorities the faculty of cancelling or deducting tax payments on property, construction, urban delineation and/or complimentary construction taxes, for building projects that are environmentally sustainable and that comply with the conditions established in the law. Tax deductions would have to be granted and renewed annually.

Once the law is enacted, the state and other public entities will have to comply with measures oriented to the achievement of energy and water efficiency and waste reduction in existing public buildings. Furthermore, new construction building projects should adjust their characteristics to comply with the established environmental requirements in the law project.

- At the local level, the project agreement No. 186 of 2008 in Bogota, proposes the development of a construction code, based on existing certification systems (PDA, 2008).

Currently there are no green building technical standards available in Colombia, however according to the National Planning Department, other relevant initiatives to promote green building policy-making are (DNP, 2013):

- The inter-institutional sustainable building working table was created on 2012, where governmental agencies, non-governmental organizations and universities participate.

- Current initiatives of the inter-institutional working table are: development of the Energy and Water Efficiency Guideline for Buildings, Colombian Environmental Seal for Green Buildings, Seals of the National Saving Fund, Bioclimatic Guide of Housing and Urbanism, energy profile of buildings and a study on GHG emissions derived from urban housing.
- Development of public policies to procure environmental sustainability in buildings such as: environmental urban management policy, national policy for climate change, national policy for the consolidation of the city system, national policy of urban drainage, public policy of eco-urbanism and sustainable building for Bogota, and the Sustainable Housing Habitat Strategy.

The Colombian government is currently working on creating a national green building policy framework, seeking to align such policies with strategic national plans. To do so, the National Planning Department has designed a matrix map that aligns green building strategies with climate change adaptation and mitigation strategies. Figure 3.1 shows the counterpoints between climate change adaptation and mitigation strategies and green building.

Figure 3.1 “Counterpoints between adaptation and mitigation to climate change strategies and green building policies (DNP, 201

Life cycle of the built environment	Climate change adaptation / risk management	Climate change mitigation
Land	Secure Location	Closeness to transport systems
Materials	Sustainable sourcing of construction materials	Carbon-efficient process for the collection, processing and transport of construction materials
Design	Material selection considering current and future characteristics of the zone	Criteria that promotes natural ventilation
	Appropriate sewage systems to dispose of rainwater and wastewater (considering climate change scenarios)	Criteria that promotes natural light
	Innovation considerations according to the future characteristics of the zone	Use of solar heating systems for water pre-heating
	Alternative energy systems, such as solar and wind energy	
Construction	Verify that construction techniques are risk-free	Use of carbon-efficient machinery
	To have basic sanitary services, urban sewage and waste disposals, considering the risk involved in providing them	
Use and Operation	Water management (waste water and water reuse treatment)	Energy efficient equipment and systems
Final Use		Material recycling and reuse
Planning and governance	Use of existing information / Generate risk information and their components (at the local level), and its incorporation to planning instruments	Information generation about emissions from materials and design

## 3.2.2 Institutional Programs

### Energy Efficiency

- **PROURE (National Program for the Rational and Efficient Use of Energy and Renewable Energies)**

The PROURE organizes its strategic actions through the Indicative Action Plan (IAP) of 2010-2015 and aims to promote the rational and efficient use of energy and other forms of non-conventional energy, in order to ensure a full and appropriate energy supply, Colombia's economic competitiveness, consumer protection and the promotion of renewable energies, considering environmental sustainability (PROURE, 2010). In its section SR-4, the plan designates the development of an energy efficiency sub-program, focused on the social housing sector, which intends to improve users' quality of life, through the use of adequate and thermal materials, improved lighting and the use of efficient home appliances (MME, 2010).

The sub program sets the following lines of action:

- (a) Development of energy efficiency standards for housing developments and the adoption of regulations for design and construction processes and for an efficient and sustainable building operation.
- (b) To create bioclimatic architecture standards for housing developments that implement energy efficiency and renewable energies.
- (c) Strengthening of educational programs and research on construction systems, architecture design, efficient use of materials and material sourcing, efficient appliances, waste management and recycling.
- (d) Energy efficiency capacity building oriented to house users.

(e) Development of energy efficient social housing pilot projects for the urban context.

(f) Creation of an electric energy pre-sale program that sells energy to low-income neighborhoods and the rural sector (MME, 2010).

The IAP 2010-2015 has the objective of implementing the PROURE, and through one of its projects, called Energy Efficiency for Buildings, it focuses some of its strategic actions to the elimination of institutional barriers to achieve the development and implementation of the plan. In terms of policy-making, the IAP reviews and promotes diverse models of energy efficiency services, it promotes technical capacity building, specialized on design and construction, technology exchange and the use of financial mechanisms that facilitate the access and use of existing credits (MME, 2011).

- **Clean Development Mechanism (CDM)**

The CDM allows industrialized countries to implement projects of GHG emission reduction in developing countries' territories, in sectors such as industrial, energy, forestry, waste and transport. Colombia has been quite successful in the implementation of CDM projects; in 2009, the country became the fifth country in Latin America, and twelfth country in the world, with more CDM eligible projects (SCN, 2010). To the year 2014, Colombia has a portfolio of 197 nationally approved projects (57 of them approved by the UNFCCC), from

which 56 correspond to the energy sector and 46 of these are related to renewable energies projects (MADS, 2014).

The IAP 2010-2015 is the planning instrument that seeks to help overcome the existing institutional barriers to access financing mechanisms to fund technologies for the development of CDM projects (MME, 2011). Furthermore, the Colombian Strategy for Low-Carbon Development will promote the transfer of technology and enhance competitiveness on all sectors facing a global economy. It will do so by orienting its objectives to understanding and harnessing investment options for national and international budgets, including the appropriate market mechanisms to access resources that facilitate low-carbon development on all sectors *ibid*.

## Sustainable Building

- **Low-Income National Macro Projects (LINMP)**

The second generation of LINMP are established in the context of the NDP 2010-2014, which contemplates the development of friendly homes and cities. The LINM are promoted by the state with the objective of increasing the supply of suitable space for the construction of social housing developments, especially on territories that present an aggravated housing deficit (MV, 2014). The Ministry of Environment and Sustainable Development issued the resolution no. 1968 of 2012 that establishes reference terms for the development of a pre-feasibility environmental assessment for the LINMP.

The reference terms allow the evaluation of the LINMP so that the Autonomous Regional Corporations can emit a favorable pre-feasibility environmental declaration *ibid*.

- **Sustainable and competitive cities platform**

On 2012, the Inter American Bank of Development selected Colombia to be a part of the Emergent and Sustainable Cities Initiative (ESCI). The ESCI addresses topics related to environmental, urban, institutional and fiscal challenges, with a methodology that encompasses three dimensions, which are:

- 1) Environmental sustainability and climate change;
- 2) urban sustainability and
- 3) fiscal sustainability and governance. This methodology has been applied in over 20 Latin American and Caribbean cities (Findeter, 2014).

The Sustainable and Competitive Cities program emerges from the ESCI, and it's a platform that aims to contribute to the ordered construction of intermediate cities, with a sustainable growth that satisfies the basic needs of the population and provides job opportunities, security and education, and that guarantees the efficient use of natural resources, while adapting to climate change

- **Evaluation and Diagnosis of Experiences Program**

Still in a developing stage, it's a program of evaluation and diagnosis of urban and construction experiences, that seeks to analyze the results of implemented sustainable strategies. The study includes the review of national and international experiences, the consolidation of a conceptual framework, the analysis of experiences regarding sustainable housing and finally, the development of guidelines and recommendations for policy-making.



### 3.2.3 Research Organizations

- **Colombian Construction Chamber (CAMACOL)**

Non-profit professional association that brings together national businesses and professionals related to the construction value chain. CAMACOL looks after the interests of the construction industry and is constituted by constructors, industry representatives and the commercial sector.

- **Construction and Urban Development Regional Education Center (CUDREC)**

Founded on 1973 as a non-profit organization, the CUDREC works on developing technical courses and activities related to the construction sector in the country. Up to 2011, they have published nearly 400 national and international studies, on topics that include urban regional planning, construction sector, social housing policies and housing deficit management, comprehensive studies on housing needs, poverty, equality, housing subsidies, information systems and urban indicators.

- **Colombian Green Building Council (CGBC)**

The CGBC works on the promotion of sustainable building concepts and actions. One of their main objectives is to support the government in the creation of policies for the construction sector, specifically regarding production and responsible consumption (CCCS, 2014). One of their most relevant initiatives is a manual that provides a guideline to developers and local authorities, about the implementation of urban-scale sustainable concepts and the influence of variables such as climate, cultural preferences and population size *ibid*.

- **Social Housing Working Table, "Diego Echeverri Campos" by the University of Andes.**

It's a public-private committee, created in 2000 through an initiative by the former Ministry of Economic Development (now called the Ministry of Housing, Cities and Territory), and the Engineering Department of the Andes University. The working group brings together key actors related to the national social housing sector and research, production and regulation organizations. They work to promote and discuss strategic proposals to face the housing deficit.



Green cover Alloat Bogota Airport, one of the hotels in Colombia with LEED Leadership in Energy and Environmental Design. (Source: coronamejoratuvida.com)



## 3.3 Case Studies



Center for Sustainable Innovation and Business Ruta, won the award "Gold Seal Sustainable America", and is in the process of certification to LEED New Construction environmental seal V. 3.0. (Source: globalsiteplans.com)

- **Sustainable Center for Innovation and Business, Ruta N**

Built in Medellín, it's a national sustainable building model that was developed by an initiative of the city council, the private sector and Public Enterprises of Medellín. The project seeks to serve as a platform to promote the creation of new businesses based on technological innovation. Among the most important implemented sustainable strategies are the efficient use of water, biodiversity conservation, refrigeration and building envelope systems, natural lighting, use of alternative artificial lighting and the use of low impact and environmental-friendly materials (CCCS a, 2014).

Regarding water management systems, the building used efficient toilets that saved up to 40 % of water consumption and a rainwater collection system was implemented for its use on discharge equipment and gardens. Endemic plant species were used for green areas to promote the local flora and to contribute to the zone's biodiversity. The building envelope provides adequate indoor thermal conditioning, and the building is designed to provide natural ventilation in combination with efficient refrigeration equipment that ensures proper temperature and humidity indoor conditions.

The enclosure system is designed to reduce the use of artificial lighting, in combination with strategically placed, high-efficiency lighting to achieve adequate lighting conditions for each indoor space. This is complemented with an automated system that controls the amount of artificial light, according to the levels of natural light that comes through the windows. Also, one fourth of the materials used in the construction are local products that contain a high proportion of recycled materials. All of the wood is certified with the FSC (Forest Stewardship Council) seal, which certifies the responsible use of forestry resources. Furthermore, by recycling a great proportion of the waste that was generated during the construction process, environmental impacts were greatly reduced.

- **Ciudadela Maiporé**

Regarding successful projects on sustainable urbanism, Ciudadela Maiporé is an example of a successful case of a social housing development that incorporates sustainable urbanism principles. It is located in the municipality of Soacha, south of Bogotá, built with the support of Colsubsidio, a national family compensation fund (COLSUBSIDIO, 2010).

It's a 183-hectare project with 16,000 houses for low and middle-income families. The project provides other facilities that complement the housing units, such as schools, a medical center, three local commercial centers, one cultural center and a transport terminal.

The strategy of the project is based on three pillars that provide coherence and solidity to the proposal, which are the environmental, social and economic aspects. The project seeks to provide the community with a high quality of life, a low environmental impact and social responsibility. To achieve this, the project establishes a series of specific actions that go from water management, adequate management of green areas, a land use proposal and transportation systems.

For the water management aspects, the project proposes the following strategies: green infrastructure with vegetated channels of absorption in conjunction with linear parks, green streets and natural wastewater treatment systems. Also, the urban design respects the natural topographic conditions of the area, procuring the natural flow of water through the linear parks, helping reduce the amount of rainwater that is lost. Regarding green areas and the use of open spaces, 50 % of the total area was destined for parks, plazas and boulevards that are near a 7.2-hectare lagoon that functions as a rainwater regulation system. This green systems also ensures user's contact with nature in a walking distance. Another important aspect about open spaces is the unique character of each one; the intention was to generate a variety of environments that promote activities.



*Citadel Maiporé in Soacha, Colombia, affordable housing. (Source: publico2.colsubsidio.com /)*

## 3.4 Future actions

Some of the most relevant initiatives currently still in progress are: the issuing of the Law Project No. 119 of 2012, which intends to offer incentives for green buildings and to set general parameters of sustainability for buildings; to conclude the developing phase and begin the implementation stage of the Energy and Water Efficiency Guideline for Buildings, Colombian Environmental Seal for Green Buildings and the Seals of the National Saving Fund. Also, the National Planning Department published a list of pending initiatives to define sustainable building public policy guidelines. These include: To help local governments define incentives that promote sustainable building; to define design and construction technical standards for the efficient use of resources; the implementation of the Green Mortgage program and to promote government programs and contests (DNP, 2013).

According to Colombia's context and the progress made on sustainable building initiatives, recommendations for future actions and policy-making are:

- Development of an institutional system to monitor and evaluate the compliance with energy and water efficiency measures and other sustainable building practices, in order to verify the performance of buildings during their operation stage.
- Development of social housing projects and building developments that incorporate energy efficiency and sustainable building practices under the CDM scheme.
- Development of a green building national strategy that integrates current initiatives and articulates a long-term vision for the sustainable building sector, with special focus on the social housing sector.
- To bridge the existing gap on technical knowledge and capacities of the public sector, with the aim of ensuring an adequate and effective implementation of the sustainable building and energy efficiency policies currently in progress.
- To issue policies that articulate the development of sustainable building institutional programs that align with the National Climate Change Adaptation Plan, the Colombian Low-Carbon Development Strategy and other transversal programs related to green building and energy efficiency.
- Create national and international financing mechanisms that fund the development of sustainable building public policies, and the implementation of priority and catalyst projects.
- Lead by example; establish policies for public acquisitions that ensure the incorporation of energy efficiency and sustainable building practices in public buildings.
- North- south and south-south cooperation networks of knowledge and best practices transfer.

*Building doctorates from the National University of Colombia in Bogotá. It has solar panels and green roof. By architect Steven Holl. (Author: Steven Holl: Source: inhabitat.com)*





## 3.5 Learned lessons

Colombia is currently constructing the institutional structure that will allow the incorporation of sustainable building policies into their national strategies. An example of this is the planning matrix (Figure 3.1) designed by the National Planning Department that shows the counterpoints between climate change adaptation and mitigation strategies and green building practices. Furthermore, the inter-institutional green building working table, created in 2012, is currently in the process of articulating regulatory frameworks, codes, seals and norms that set sustainability parameters for buildings and cities.

In 2001, the state established the national legislation that declares the rational and efficient use of energy a national matter and priority. Government authorities are currently working on setting up maximum and minimum energy efficiency levels and parameters for the building sector. Additionally, short-term priority measures such as light bulb replacement, and incentives for the use of energy efficient appliances have been adopted. The Green Mortgage program, based on the Mexican case, is one of the main energy efficiency initiatives to be implemented in the social housing sector.

On 2010, the PROURE program established a sub program for the development of energy efficiency measures applicable to buildings and low-income houses.

The strategic actions of this program are:

(a) Development of energy efficiency standards for housing developments and the adoption of regulations for design and construction processes and for an efficient and sustainable building operation.

(b) To create bioclimatic architecture systems for housing developments that implement energy efficiency and renewable energies.

(c) Strengthening of educational programs and research on construction systems, architecture design, efficient use of materials and material sourcing, efficient appliances, waste management and recycling.

(d) Energy efficiency capacity building oriented to house users.

(e) Development of energy efficient social housing pilot projects for the urban context.

(f) Creation of an electric energy pre-sale program that sells energy to low-income neighborhoods and the rural sector (MME, 2010). These strategic actions show that the development of energy efficiency measures applied for the building sector are still a work in progress in Colombia.

The National Development Plan of 2010-2014 incorporates climate change as a central issue in the national public policy agenda and at the same time, recognizes the construction sector as an economic growth engine for the country.

Some of the main strategies that derive from the NDP are the Climate Change National Adaptation Plan and the Colombian Strategy for Low Carbon Development, both still in a developing stage.

Through these and other strategies such as the National Policy for the Consolidation of the City System, the National Policy of Urban Sewage, Public Policy of Eco Urbanism and Sustainable Building for Bogota and the



Strategy of Sustainable Housing Habitat is that green building transversal strategies are being established to incorporate sustainable building in the public policy agenda.

Regarding public policies that seek to incentivize sustainable building, one of the most relevant is the Law Project No. 119 of 2012, still in the process of being approved, which intends to establish the sustainable requirements to grant tributary discounts and incentives for the implementation of sustainable building practices. Also, some of the most important instruments in a developing stage are the Energy and Water Efficiency Guideline for Buildings, Colombian Environmental Seal for Green Buildings, Seals of the National Saving Fund and the Technical Guideline of Energy Efficiency for Low-Income Housing. All of these instruments set a baseline that builds an institutional capacity to transit from the planning, to the implementation stage.

Among the recommendations for future initiatives and policy-making, are creating monitoring and evaluation systems to determine the performance of buildings where energy efficiency measures have been implemented. Also, given the fact that Colombia is one of the countries with the most registered CDM projects, it is recommended to include building and social housing projects that consider energy efficiency measures, renewable energies and sustainable building practices. It is also recommended to strengthen and create south-south and north-south cooperation alliances and to create mechanisms for institutional capacity building, with the objective of closing any existing knowledge and experience gaps.

Finally, it is considered important that the state leads by example and sets the objective of implementing sustainability measures to all public buildings in order to incentivize the rest of the local market to apply a more sustainable building model.

# Chile



## 4.1 Context

On 2012, the Republic of Chile had a population of 17.4 million people (Banco Mundial, 2014). Among the Latin American economies, Chile has presented the most rapid growth in the last 20 years, with an annual average growth rate of 3.5 % and also, in real value terms, the income per capita has doubled in this same period *ibid*. Chile is a democratic republic with a decentralized administration, which is divided into 13 regions, 51 provinces and 342 communes (RHII, 2007). The capital city is Santiago, where 40 % of the population is concentrated and where the executive and judicial powers are located *ibid*.

The political constitution of Chile guarantees the fundamental right to live within a clean environment, free from environmental pollution, and attributing to the state the responsibility to preserve and care for the natural environment (SCN, 2011). Considering this, sustainable public policies have been incorporated into the national development strategies *ibid*. Since 1994, Chile is part of the UNFCCC and they ratified the Kyoto Protocol on 2002 (MMA, 2014). As a non-annex I country, Chile is not committed to mandatory reductions of carbon emissions, however, on August 23 of 2010, the country officially informed the UNFCCC their commitment to a voluntary reduction of 20% of their GHG emissions for the year 2020 (MOP, 2013).

Climate change is now one of the five strategic pillars in the agenda of Chile's Ministry of Environment. The Climate Change Office of the Ministry of Environment is responsible of executing initiatives on the topic, and in 2006 issued the National Action Plan on Climate Change (NAPCC) 2008-2012 (SCN, 2011; MMA, a 2014). The NAPCC establishes the application of energy efficiency measures and the use of renewable energies for buildings as a priority action line, implemented in the period of 2008-2012 (PANCC, 2008).

Regarding the inventory of GHG and CO<sub>2</sub> emissions, on 2008 Chile produced approximately 0.26 % of the total global emissions, and occupied the 61st place globally, according to their annual production of CO<sub>2</sub> per capita (SCN, 2011). According to the Second National Communication of 2011, from the year 1990 to 2006, the net GHG emissions increased 232 % and from 2000 to 2006 they increased 37 %. In general terms, the energy sector has a dominant contribution to the GHG emission values (with an increase of 85 % between 1990 and 2006). Likewise, in 2006 the energy sector produced a great proportion of the GHG emissions (57.806 tons from a total of 59.572, considering a reduction of -19.386 that corresponds to the contribution of the change in land use, land and forestry sector, derived from carbon capture) *ibid*.

The sustained economic growth of the last years (annual growth rate of approximately 5.4 % between 1986 and 2010) carries parallel growing challenges, such as the need to increase the energy supply. In 2011, the energy demand increased 6.8 % in respect to 2010 and an approximate growth between 6 % and 7 % is projected for the year 2020 (ENE, 2012). On 2007 the demand of energy consumption had a uniform tendency across regions; in average, the region's main local activity consumed 30 % of the energy demand (for most regions the main economic activities are either the industry sector with an average of 29 % of energy consumption or the mining sector with an average of 33 %) and the residential and commercial sector represented 26 % of the energy consumption, among most of the regions (INE, 2007).





Cover: Glass Bottling Plant in V Region, Chile. By Guillermo Hevia Architect (Photo: Felipe Camus Source: archdaily.com)

On this page: CityPark Santiago, a set of 9 8-story buildings, will add to the supply of premium office (class A +) Huechuraba (Source: diario.latercera.com)

Since 2005, the state has made efforts to position energy efficiency as a topic of national priority. The National Energy Strategy (NES) of 2012-2030 establishes the goal of achieving a reduction of 12 % on the final energy demand to the year 2020 (ENE, 2012). To do so, a series of measures are established, such as the Energy Efficiency Action Plan (EEAP) 2012-2020, which incorporates measures to promote energy efficiency among different productive sectors, including the construction sector *ibid*.

The construction industry in Chile represents an average of 7.8 % of the national GDP, 8.46 % of the created jobs, it's the source of 34 % of the generated waste, and considering only the operation stage, the sector consumes nearly 26 % of the final use of energy demand in the country (ENCCS, 2013). It is estimated that from 2009 to 2011 the housing deficit grew 17.8 %, going from 420,587 to 495,304 housing units, mainly in the area affected by the earthquake of February 2010 (CASEN, 2011).

As the country has made economic progress, public policies that plan and foresee elements such as location, poverty concentration, security, overcrowding, connectivity and access to urban infrastructure have been neglected, situation that currently constitutes one of the country's greatest challenges (PNDU, 2013). To face these challenges, in 2012 the state enacted the National Policy of Urban Development (NPOD), which aims to generate conditions to improve people's quality of life, based on the concept of sustainable development *ibid*.

Besides having established a long-term vision for the urban development sector, Chile is an exceptional example of progress in terms of sustainable building public policy. Proof of this is the recent enactment of the Sustainable Building National Strategy (SBNS) 2013-2020, which sets the objective of establishing the main pillars to integrate the concept of sustainability into the planning, design, construction and operation of buildings and infrastructure (ENCS, 2013). The SBNS establishes expected results for the year 2020, which are: to have sustainable buildings and infrastructure; to contribute from the commercial, public and residential sectors to the reduction commitments of 12 % of the total energy consumption; to contribute from the building sector to the national objective of reducing 20 % of the GHG emissions and that at least 10 % of the energy used in the building sector is generated from renewable sources *ibid*.



## 4.2 Baseline

The NES 2012-2030 is the guideline that defines the objectives and commitments regarding the national energy policy. It establishes the objective of reducing 12 % of the final energy demand to the year 2020, designating 20 % of the total savings to the construction sector (the construction sector is intended to save 8.500 Tcal of the total 43.000 Tcal projected savings) (Pavón, 2013). The EEAP 2012-2020 articulates the vision of the NES through a series of initiatives and programs that guide the different sectors (industry, mining, timber, products, transport and building) to orient their actions towards the increase of energy efficiency. The action lines for the building sector include the commercial, public and residential sectors, and establish the following:

- To improve the energy quality of the building envelope and equipment in existing buildings that don't consider energy efficiency standards. To promote energy efficiency management in buildings.

- To promote the design of buildings with high energy efficiency standards.
- To promote the supply of building products and services with energy efficiency criteria.
- To promote energy efficiency in lighting systems of public roads, pedestrian areas and urban zones.

Besides the mentioned specific action lines for the building sector, the EEAP contemplates transversal initiatives such as the creation of an energy efficiency label, the integration of the concept of energy efficiency in education courses and the promotion of research and development of energy efficiency measures, among others (PAEE, 2013).

Figure 4.1 Sustainable Strategy Lines and Actions of the Ministry of Housing and Urbanism (MVU, 2014).

Sustainable Strategic Lines and Actions				
Strategic lines	Quality of Life and Competitively	Sustainability in Buildings and the Environment	Education, Innovation and Entrepreneurship	Local Government, Global Responsibility
Actions	Improvement of the universal accessibility standard	Natural resource preservation: water, energy, etc.	Promote the development of excellency for sustainable buildings and cities.	Participation in international sustainable building working tables.
	Improvement of the efficiency of buildings and cities.	Development of a sustainable building code.	Sustainable building education for professionals.	De-contamination plans for saturated zones.
	Incorporate of non-conventional renewable energies to supply rural schools and hospitals.	Reconditioning plan for existing buildings.	Development of the Innovation and Entrepreneurship program	Development of a national sustainable building strategy
	Establishment of minimum energy efficiency standards	Promotion of building design and energy efficiency management	Energy efficiency and sustainable buildings talks to neighborhood leaders	Public Building Energy Efficiency Program (PBEEP) for the building reconditioning of priority public buildings.
	Energy Efficiency Action Plan 2012-2020	Energy efficiency labeling for new housing.	Energy management contest under ESCO's model, for the implementation of non-conventional renewable energies for building supply	Foundation of the Interministerial Energy Efficiency Committee.
	Hearer replacement in house located in saturated zones.	Noise standard for construction activities.	Education for sustainability and environmental certification of environmental education.	Municipalities with environmental certification and clean points.

The recent publication of the SBNS positions Chile a step ahead from other Latin American countries, in terms of green building public policy development, where the country integrates strategic action lines to stimulate sustainable building practices in the country. Chile shows a wider understanding of the concept of sustainable development, by integrating into the SBNS topics such as green building construction codes, access to universal mobility, increase in the number of meters of green space per person, GHG reduction, ecosystem protection, adaptation to climate change and governance, among other concepts. In this sense, the country has taken further steps to align the efforts that have been done in the past years, on the national and sub national level.

In August 2012 an inter-ministerial collaboration agreement was signed between the Ministries of Public Works, Housing and Urbanism, Energy, and Environment, with the aim of coordinating, promoting and disseminating sustainable building practices in the country. Additionally, the Executive Secretariat of Sustainable Building was created as the responsible organization for the implementation of strategies and objectives (MVU a, 2014).

As in other Latin American countries, in Chile, energy efficiency has also become a central topic at the national level. The country has developed a solid structure of public policies and programs that include sustainability practices in the building sector as a means to reduce energy demands in the residential, commercial and public sectors, while also using it as a strategy to obtain cost-effective benefits.

Chile has achieved both the development of policies as well as the first steps towards the implementation of laws, norms, codes and seals, which are focused on establishing minimum sustainable building standards and promoting green building practices in the following categories: energy, water, waste, health, wellbeing and others.

Along with this, Chile stands out for the development of strategic lines and actions to achieve the implementation of sustainable building and urbanism practices in a wider sense. The Ministry of Housing and Urbanism published Figure 4.1, which shows key strategy lines and actions for the implementation of sustainable building and urbanism practices in Chile.

From these strategic actions, the publication of the SBNS 2013-2020 is highlighted, as it is a focal institutional instrument that establishes the counterpoints between sustainable building plans and strategic national plans, such as the National Energy Strategy 2012-2030 and its Energy Efficiency Action Plan 2012-2020, the Urban Development National Policy and the National Action Plan on Climate Change 2008-2012, among other national strategies and cross-sectorial plans. The SBNS is the product of a transversal integration that approaches sustainable building from a holistic and integral perspective.

It is formed by four strategic pillars that cluster and develop priority issues for the progress of the sustainable building sector in the country. These strategic pillars are (ENCS, 2013):

**1) Habitat and Wellbeing – Vision:** Equal access to sustainable buildings and infrastructure for the whole of the population, promoting a virtuous cycle that accelerates the reconversion towards a more sustainable criteria for existing buildings and infrastructure.

**2) Education – Vision:** The country will have solid norms that clearly define national green building standards for all types of buildings and infrastructure, considering their life cycle.

**3) Innovation and Competitiveness – Vision:** Creation of new sustainable building solutions and initiatives that respond to local and global needs, by creating innovation and entrepreneurship incentives, creating the conditions for the establishment of learning centers and the establishment of a high-standard green building industry.

**4) Governance – Vision:** To achieve all of the objectives set in the strategy, following the completion through a management control system that monitors the proposed goals and evaluates the implementation of sustainable building practices, according to the plan.

Another important action is the development and publication of the Sustainable Dwelling Code, which was developed with support from the Building Research Establishment (founded by the British Embassy in Santiago), that has the objective of developing high technical standards of sustainability for dwellings, considering the different geographic and climatic conditions of the Chilean regions (MVU b, 2014).

Besides the development of a sustainable building code that is adapted to the local conditions, voluntary certifications, such as LEED have had a good market acceptance. To prove this point, Chile is among the ten countries in the world with more LEED certified buildings (Rojas, 2012). According to the LEED project directory, in 2014 there were a total of 237 LEED registered projects and 60 projects that already have a certification (USGBC, 2014).

## 4.2.1 Policies, Laws, Decrees and Norms

- The Law 20.402 was enacted on 2009 to constitute the Ministry of Energy, which includes among its divisions, the Department of Energy Efficiency, which was created to face the national challenges of energy demand and to incorporate energy efficiency as a topic into national planning. The fourth article of the 20.402 Law grants the Ministry of Energy the establishment of minimum energy efficiency standards and the founding of the Chilean Agency of Energy Efficiency (CAEE) (non-profit private foundation) to be the public policy executing arm. The CAEE's general objective is the study, evaluation, promotion and development of all types of initiatives related to the diversification, saving and efficient use of energy (Ley 20.402, 2009; PAEE 2020, 2013).
- The Supreme Decree No. 74 ordained the creation of the Inter Ministerial Committee of Energy Efficiency as an organization to coordinate energy efficiency policies and integrate cross-sectorial policies (PAEE 2020, 2013).
- In 2007, a second stage of the existing Thermal Regulation for new housing developments was enacted. Based on this reform a new subsidy program was created to promote thermal reconditioning in existing houses located in vulnerable sectors (PAEE 2020, 2013).

According to the National Normalization Institute, energy efficiency technical standards applicable to buildings are:

- NCh2677:2002 – Energy efficiency in lighting systems for non-residential buildings – Requirements.
- NCh3081:2007 – -Energy efficiency – Air conditioning systems – Classification and labeling.
- NCh3082:2008 – Energy efficiency – Ballasts of fluorescent lamps – Classification and labeling.
- NCh3149:2008 – ISO 16818:2008 – Building environmental design – Energy efficiency – Terminology
- Nch3184:2010 – Energy efficiency – Solar collectors – Labeling.
- Sustainable building is developed under the framework of the General Law of Urbanism and Construction (Law No. 458), which establishes principles, attributions and faculties for urban planning, urbanization and construction (Cerdeira, 2013). Furthermore, the General Urbanism and Construction Ordinance dictates the dispositions to regulate urban planning and construction processes and establish compulsory design and construction technical standards. In this sense, there are standards that describe the technical characteristics of projects, materials and construction systems that comply with the regulations established by the General Ordinance *ibid*.



- In 2012 a Law Project was initiated to modify the General Law of Urbanism and Construction (No 458), to add article 162 that mandates construction companies to implement energy efficiency measures in new social housing developments (PDL 458, 2012). The enactment and publishing of the project law is still in process.

Furthermore, there are sustainable building technical standards available, which were developed by the National Institute of Normalization and that are voluntarily incorporated into local building regulations and codes. The available sustainable building norms are (Cerda, 2013):

- NCh 3048/1:2007 (based on ISO/ TS 21929-1:2006) – Sustainability in building construction: Methodologies for the development of sustainability indicators, part 1 (buildings).
- NCh3049/1:2007 (based on ISO/TS 21931-1:2006) – Sustainability in building construction: Evaluation methods of the environmental behavior of the construction process, part 1 (buildings).
- NCh3055: 2007 – Guidelines to determine the indoor environmental quality in commercial buildings.
- NCh3149: 2008 (based on ISO 16818:2008) – Environmental design of buildings, energy efficiency.

In addition to the normalization of sustainable building ISO systems, in 2013 the Sustainable Dwelling Code is published and can be voluntarily implemented from 2014. The code addresses a variety of topics related to the design, construction and operation stages in housing developments (MVU b, 2014). It considers five categories and sets a set of objectives for their achievement: energy, water, waste, health, wellbeing and others *ibid*.

Chile has been very successful in the development of a sustainable building policy framework. The SBNS is a planning instrument that approaches the integration of sustainability criteria into the construction sector, in systematic and coordinated way, in alignment with environmental and energy policies and guidelines (ENCS, 2013). It contemplates four strategic pillars (habitat and wellbeing, education, innovation and competitiveness, and governance) with 16 general objectives, 32 specific objectives and 64 action lines to implement the objectives. The 16 general objectives are:

- 1) To ensure the availability of sustainable buildings and infrastructure for the population.
- 2) Contribute to the improvement of the community's quality of life.
- 3) Reduce the level of emissions derived from buildings during its life cycle.
- 4) Reduce the negative environmental impacts on the territory, caused by buildings and infrastructure.
- 5) To develop the concept of sustainable building in the country, establishing adequate standards.
- 6) Prepare buildings, infrastructure and the population against possible natural disasters and climate change impacts.

- 7) Strengthen and disseminate the concept of sustainable building among all of the actors involved in the building life cycle.
- 8) Improve sustainable building technical and professional capacities.
- 9) Incorporate sustainability criteria in buildings and infrastructure through innovation.
- 10) To improve the economic competitiveness and productivity of buildings and infrastructure.
- 11) Incentivize the adoption of the life cycle assessment for the evaluation buildings and infrastructure.
- 12) To promote efficiency in energy, water, and material systems, with emphasis on the application of passive design.
- 13) Implement the SBNS and promote relevant information about sustainable building practices at the national level.
- 14) Integrate all of the different actors involved in the implementation of the SBNS.
- 15) To ensure local representation on issues related to sustainable building and ensure the efficiency of the administrative apparatus.
- 16) Consolidate the sustainable building knowledge and experience transfer with the international



*View of solar power plant in Pampa aquifers (Photo: Patricio Fuentes, Source: diario.latercera.com)*

## 4.2.2 Institutional Programs

### Energy Efficiency

- **Housing Energy Rating System (HER)**

In 2007 the Ministry of Housing and Urbanism and the Ministry of Energy developed the HER system, which is a voluntary instrument that evaluates the energy efficiency of new dwellings during their operation stage, considering requirements on heating, lighting and hot sanitary water (MVU c, 2013). The system allows users to know the levels energy efficiency of new houses they want to acquire *ibid*.

The evaluation labels houses by colors and letters that go from A, most efficient to G, the least efficient. To evaluate efficiency performance, dwellings are compared with a "basic" house, that complies only with the minimum requirements mandated by the Thermal Regulation, established by the General Urban and Construction Ordinance. The system is organized so that each letter corresponds to a percentage of energy saving, in respect to the basic house. This way, the letter "A" guarantees energy savings up to 80 % in respect to the basic house; "B" guarantees energy savings up to 60 %; "C" of up to 50 %; letter "D" up to 30 % and the houses rated with the letter "E" are the reference or "basic" houses, with an annual average consumption of 192 kWh/sq.m. per year.

- **Energy efficiency in public and health buildings**

The CAEE implements energy efficiency programs to promote the reduction of energy demand for different sectors of consumption. In the building sector, the CAEE provides assistance in three areas: support in the design of new constructions, considering energy

efficiency criteria; support in the implementation of improvements in existing buildings, and energy efficiency capacity building and education for key actors of the construction sector (AChEE, 2014). For the last years, the CAEE has focused on the development of guidelines for the building sector. They have designed guidelines for specific sectors such as energy efficiency guides for schools, guidelines for commercial, residential and social housing sectors, hospitals and health buildings, hotels, and offices among others (ACHEE a, 2014). Some of the most outstanding implemented programs are:

#### **Energy Efficiency Program for Public Buildings**

In the year 2011 five public buildings were selected as pilot projects to incorporate measures such as improvement and operational control of processes, component replacement, technology integration, energy efficient equipment replacement and integration of systems that allow the use of untapped energy (ACHEE b, 2014). The projects were funded by the CAEE and commitments to measure and verify energy savings were established for a period of 12 years after the approval of the projects, expecting an average return on investment of 3.7 years *ibid*.

#### **Energy Efficiency Program for Hospitals:**

In 2011 measures were mainly implemented to improve building thermal systems in three public hospitals, with the aim to monitor the achieved energy savings (ACHEE c, 2014). Each hospital was projected to save 3,3 GWh with return on investment periods of 6 to 18 months, which is translated to average return on investments of less than one for the whole program *ibid*.





Housing part from General Grant DS 40 (PPPF). (Source: [serviumagallanes.cl](http://serviumagallanes.cl))

### **Energy Efficiency Program on Municipal Buildings:**

The CAEE, the National Council of Culture and Arts and the municipalities of Peñalolén, Lo Prado, Maipú and Santiago signed a collaboration agreement with the objective of implementing energy efficiency measures in municipal buildings of the respective communities in order to improve the energy performance (ACHEE d, 2014). The program consisted in the point-to-point replacement of lighting equipment *ibid*.

### **Sustainable Building**

- **Protection Program of Family Patrimony (PPFP)**

In 2006 the Ministry of Housing and Urbanism created two subsidy lines, through the PPFP program, that respond to energy consumption indicators. One line subsidizes thermal conditioning in existing constructions and the other subsidizes energy efficiency innovation projects, that promote the implementation of solar collectors, solar lighting and wastewater management systems or similar (MVU a, 2013).

Users who are feasible candidates to obtain the subsidies are social housing owners that own a house with a maximum value of 650 inflation-indexed units (Unidad de Fomento), that the house is built by the state or private sector and that the unit is located in urban or rural zones.

- **Sustainable Dwelling Code (SDC)**

The SDC is in the process of being translated into institutional programs for its implementation. According to the Ministry of Housing and Urbanism, from an economic perspective, the SDC is a tool that will help obtain financial savings for users, economic benefits for sustainable technology manufacturers and will support the development of a green economy. From an environmental perspective, it supports GHG and CO2 emission reduction in the construction and housing sector and also helps reduce waste and rubbish. From the social point of view, it intends to improve the comfort inside the houses and a long-term view towards the creation of sustainable communities (MVU a, 2014). The code establishes 42 objectives for the categories of energy, water, waste, health, wellbeing and others *ibid*. It will be published and distributed among the main actors of the construction sector during the first months of 2014 for its voluntary implementation.



## 4.2.3 Research Organizations

- **Chilean Agency of Energy Efficiency (CAEE)**

The CAEE works on the promotion, strengthening and consolidation of the efficient use of energy in the different sectors of consumption. Their main activities are to provide support in the implementation of energy efficiency measures for new and existing buildings and to provide capacity building for new professionals (ACHEE, 2014).

- **Research Center of Building Technologies of the University of Bío Bio.**

The center has worked on the elaboration of the manual, "Passive Design and Energy Efficiency for Public Buildings", which intends to develop and establish sustainable design parameters in order to optimize public investment. Other organizations that collaborated in this project are the Direction of Extension in Construction of the Pontifical Catholic University of Chile, the Scientific Research and Technological Direction, filial of the Pontifical Catholic University of Chile and the Center of Research, Development and Innovation of Structures and Materials of the University of Chile.

- **Chile Green Building Council (CGBC)**

Non-profit organization with the objectives of promoting and stimulating green building and sustainable development in the country; the development of technological innovation and sustainable building certification; the efficient use of energy and water, and the application of renewable energies, among others (GBCC, 2014). Furthermore, the CGBC was part of the organizations that conformed the technical committee for the development of the Sustainable Building Code *ibid*.

- **Construction Institute (CI)**

The CI has the mission of identifying, agreeing, promoting and coordinating initiatives to improve the construction sector's competitiveness at the national level. Their main actions have been focused on the research of cement and concrete, structures and sustainable building. One of their highlighted projects is their collaboration to develop a national energy certification for houses and also, the development of a contest for the evaluation of construction design strategies and environmental quality standards, and the efficient use of energy in public buildings.

- **Corporation for Technological Development (CTD)**

Private law organization, founded by the Chilean Chamber of Construction in 1989, to promote innovation among construction companies in Chile. Within the organization there is an energy efficiency and sustainable building area consist of a a multi-disciplinary team, whose aim is to promote sustainable building, resource management efficiency, energy in all of the stages of the architectural project and a to promote the best green building practices.

## 4.3 Case Studies

- **Subsidies for thermal reconditioning**

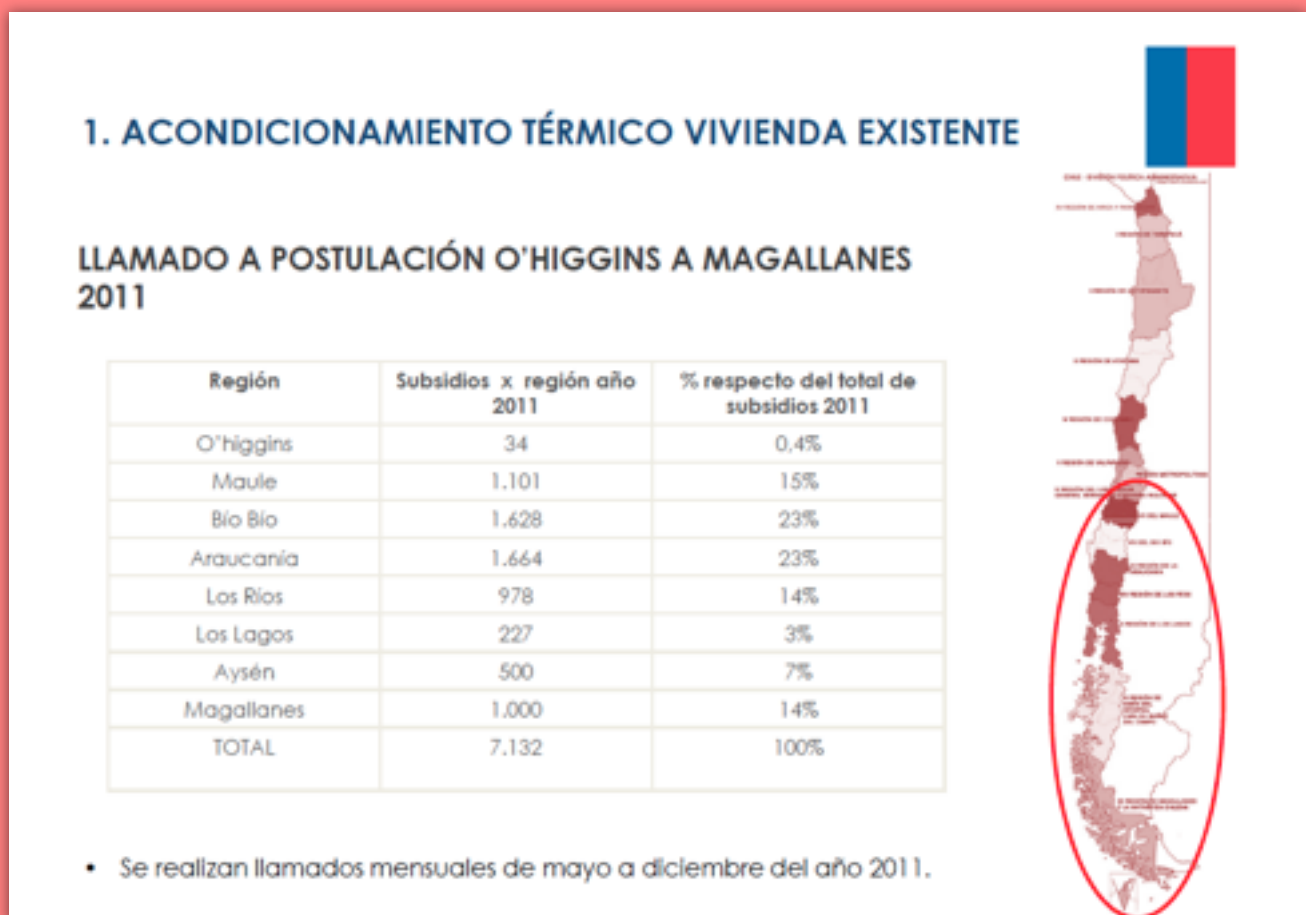
The Bio Bio region is a successful case in terms of the benefits obtained from the subsidies for thermal reconditioning given to the population through the Protection Program of Family Patrimony. Subsidies have been granted since 2009, accumulating a total of 7,965 to the year 2013; they were given to houses that were built before 2007 that do not comply with current thermal insulation regulations (Cáceres et al. 2013). According to the evaluation of houses where thermal reconditioning was implemented, it was determined that the indoor temperature increased between 0.6 to 1.1 degrees Celsius. It was calculated that this increase is quite significant, due to the fact that in order to artificially raise this amount of degrees, an increase of energy demand in the order of 15 % is required. According to calculations, users perceive savings in the order of 20 % to 33 % in the use of heating *ibid*.

Similarly, in the commune of Temuco, the project, "Quality of Life Improvement" consisted in the thermal reconditioning of 70 houses, where reductions benefits of 35 % on heating demand were obtained (MVU, 2011). Figure 4.2 shows the results of this program and Figure 4.3 shows a table of the total subsidies granted in 8 regions of the country.

Figure 4.2 Result summary of the subsidy program in the commune of Temuco (MMU, 2011., pg. 17)



Figure 4.2 Result summary of the subsidy program in the commune of Temuco (MMU, 2011., pg. 17)



- **Neighborhood Recovery Program**

The program has the objective of recovering and providing public spaces to the community through a process of public participation. The program promotes a paradigm change for the implementation of public policies, where the main focus is to create a new relationship between the state and the citizens, based on a decision-making process where decisions for the neighborhood and the city are taken through a participation and dialogue process (MVU, 2010). A pilot project of 200 neighborhoods in 80 communes along the 15 regions of the country began in 2012, later becoming a permanent institutional program of the Ministry of Housing and Urbanism (MVU c, 2014).

The program is composed of 5 pillars, which are: participation, inclusiveness, decentralization, flexibility and sustainability (MVU c, 2014). Several projects that consider energy efficiency have been implemented, where LED lighting was incorporated in existing buildings, obtaining up to 75 % of energy savings and reductions of CO2 emissions of up to 75 % (MVU a, 2013). Additionally, neighbors have formed environmental committees in order to incorporate LED lighting and solar panels in all sectors, and also to build new social centers where sustainable building practices have been implemented. The implemented practices include: thermo panels, double insulation with air chamber to reduce heating demand and passive building designs that use natural light in summer and winter *ibid.*

Figure 4.4 Solar public lighting in public spaces of the El Roble Chillan neighborhood (MVU a, 2013., pg. 24)



Figure 4.5 Social centers the neighborhoods of Santa Filomena and Pope John Paul II (MVU a, 2013., pg 25)





## 4.4 Future actions



*The TRANSOCEANICA Building is the first building in Chile LEED GOLD certification. (Source: archdaily.mx)*

In 2014 Chile will begin to implement priority strategies such as the Sustainable Dwelling Code. Another initiative that is currently in approval stage is the Law Project No. 458, that proposes the incorporation of an article (162) to the General Law of Urbanism and Construction, which mandates construction companies to implement energy efficiency measures to low-income houses.

Considering the Chilean context, the strategic plans established in the Sustainable Building National Strategy and the strategic action lines proposed by the Ministry of Housing and Urbanism, recommendations for future green building policy-making and initiatives are:

- Development of regional cooperation networks for capacity building and adequate policy-making at the local level, in alignment with national sustainable building policies.
- Development of local incentives for the implementation of the Sustainable Dwelling Code.
- Establishment of time limits and priority actions for the plans included in the Sustainable Building National Strategy.
- Development and implementation of public-private partnerships, for the implementation of sustainable building strategic plans.
- Establishment of a third-party monitoring mechanism that calculates energy savings and emission reductions in buildings and housing developments.

## 4.5 Lessons Learned

Chile stands out from other Latin American countries due to the development of policies and planning instruments that position sustainable building as topic of national importance. The country also shows an institutional solidity in terms of energy efficiency policy, where besides the development of policies, strategies and norms, the country has established institutional programs for the implementation of energy efficiency measures in the social housing sector and in diverse building sectors, with favorable results.

Sustainable building is explicitly integrated into the national public policy agenda through the Sustainable Building National Strategy 2013-2020. This planning instrument aligns sustainable building strategies with national strategic plans, such as the National Energy Strategy and the Energy Efficiency Action Plan 2012-2020, the National Policy of Urban Development and the National Action Plan on Climate Change 2008-2012, among other cross-sectorial plans. The SBNS establishes the strategic plans for the implementation of green building practices, understanding the concept from a holistic and wider point of view.

At the national level, there are sustainable building technical standards available, which were developed by the National Institute of Normalization and that are applied voluntarily. The standards were developed based on the ISO system for sustainable building and cover the following topics: methodologies for the development of sustainability indicators; evaluation methods of the construction process' environmental behavior; guidelines to determine the indoor environmental quality in commercial buildings and building environmental design to achieve energy efficiency.

Additionally, the Sustainable Dwelling Code was published on 2013, and is available for voluntary implementation from 2014.

The code addresses a variety of topics related to the design and construction stages and the operation of buildings. Both the code and the green building technical standards are some of the tools employed to implement green building practices, that will help modify the construction paradigm, towards a more sustainable building industry.

Regarding policies oriented to promote energy efficiency in the building sector, the National Energy Strategy establishes the goal of reducing 12 % of the final energy demand to 2020, assigning 20 % of the energy savings to the building sector. The Energy Efficiency Action Plan 2012-2020 articulates the vision of the NES and establishes specific action lines for the commercial, public and residential sectors. Some of the proposed actions are: to promote building design with high-energy efficiency standards; to promote building energy efficiency management during the operation stage and to promote products and services with efficiency criteria, among others.

One of the most relevant energy efficiency initiatives is the Housing Energy Rating system, which is a voluntary instrument that evaluates and allows users to have information regarding the level of energy efficiency of new houses, during their operation stage. This program positions Chile as a Latin American pioneer that like developed countries, such as United Kingdom, in now implementing a labeling system that allows users to know the energy performance of constructions.

Another important program is led by the Ministry of Housing and Urbanism, which created two subsidy lines; one to subsidize thermal reconditioning of existing houses and the other for energy efficient innovation projects, which promote the use of solar collectors, solar lighting and wastewater management systems or similar. Since 2009, a total of 7,965 subsidies have been granted along the regions, and according to calculations, users have saved from 20 % to 33 % of the use of heating. Furthermore, the CAEE implements energy efficiency programs that promote the reduction of energy demand in different consumption sectors. They focus on the specific use of buildings and develop energy efficiency guidelines for schools, commercial buildings, low-income houses, the residential sector, hospitals and health establishment, hotels, offices and others.

Finally, some of the future recommendations are the development of regional cooperation networks that provide technical capacities to local policy-makers, in order to align sustainable building policies among the different levels of government. The development of local incentives for the implementation of the Sustainable Dwelling Code is also recommended. Finally, given the fact that Chile is currently going through the implementation of its green building and energy efficiency policies, and governments rarely have the institutional capacity to execute all of their plans, it is recommended to establish public-private alliances, where the government shares responsibilities and benefits of implementing their strategies.



HSBC 

# Mexico





## 5.1 Context

According to the National Population Council, in 2013, Mexico had a population of 118,419,000 inhabitants and was the second largest economy in Latin America (Hernández et al., 2013). Mexico is a democratic, federal and representative republic, divided into 32 states, 2,456 municipalities and a federal district, which is integrated by 16 political delegations and is home of the executive, legislative and federal powers (QCN, 2012). Mexico is a mega diverse country that occupies the fourth place in the world in terms of natural capital *ibid*.

Throughout the years, Mexico has shown a committed leadership towards implementing sustainable development measures at the national level. The country is part of the international agreements of the UNFCCC signed on 1993 and the Kyoto Protocol, ratified on 1998, and also the only Latin American country that has published five national communications before the UNFCCC (INECC, 2014). The National Development Plan (NDP) of 2007-2012 established the vision of achieving a sustainable human development and promulgated Environmental Sustainability as one of the five main pillars that structures the NDP, where also, the development of a Climate Change National Strategy was projected for the first time (QCN, 2012).

The General Law of Climate Change was enacted in 2012 (Mexico is the second country in the world after the United Kingdom that has sanctioned a specific national law for climate change), which establishes the national goal of reducing 30 % of its GHG emissions to the year 2020 and 50 % of them to the year 2050. In its eighth and ninth article, the law mandates national and sub national governments to develop strategic plans and public policies oriented to climate change mitigation and adaptation (LGCC, 2012).

According to the GHG emission inventory presented on the Fifth National Communication, in 2010 the energy sector produced 67.3 % of the total GHG emissions and the industrial processes sector produced 8.2 %. GHG emissions from the energy sector are categorized as follows: 32.3 % comes from the energy industry, 11.3 % from the manufacture and construction industries and 6.9% from other sectors (residential, commercial and agriculture), among others (QCN, 2012). Regarding the final use of electricity, the residential sector consumes 16.2 %, the commercial and public sectors consume 3.4 % and cement production consumes 4.36 % of the total electric energy demand (ENCC, 2013; QCN, 2012).

The Mexican Chamber of the Construction Industry estimates a growth of 3.5 % in the construction GDP in 2014 (CMIC, 2013); it has also been projected that to the year 2050, Mexico's population will increase approximately to 122 million people, that to the year 2030 the construction of 11 million new houses will be required and that for the same period, about 9 million housing units will require total or partial renovations (INEGI, 2010 and CONAPO, 2013 cited in ENVIS, 2013). Also, to 2014 a housing deficit of 8 million units is estimated (Tapia, 2014).

The significant population growth and the increasing housing requirements are directly translated into an increase in water and energy demand, which represents a challenge for the social housing sector in the country (ENVIS, 2013). Similarly, climate change and water scarcity are two of the main environmental challenges the country faces.

In this context, the Mexican government has determined that the social housing sector plays a central role in the development of initiatives and actions towards GHG emission mitigation, in meeting development and economic growth needs, and in making progress towards a sustainable use of energy, water and gas (ENVS, 2013).

As a result of the previously mentioned national priorities, Mexico stands out from other Latin American countries for their leadership and their progress in the development and implementation of sustainable social housing programs (ENCS, 2013). Examples of this are the Green Mortgage Program, which is an international model and success case, the Integrated Sustainable Urban Developments (DUIS, for its acronym in Spanish), the Ecocasa-SHF program, the Integral Life Infonavit program, the Sustainable Housing program and Nationally Appropriate Mitigation Action (NAMA) projects, among others. Mexico perpetuates its leadership position in this sector with the publication of the National Strategy of Sustainable Housing (NSSH), which was published in 2013 as a planning instrument, with the objective of aligning the existing sustainable housing programs and initiatives, in order to achieve higher levels of efficiency that result in an improvement of the user's quality of life and tangible environmental benefits (ENVS, 2013).



Cover: The HSBC Tower in Mexico was the first tower to be certified as a green building LEED GOLD in Mexico and Latin America. (Source: prweb.com)  
On this page: Pilot "Green Mortgage" Development in Mexico. (Source: pve.unam.mx)

## 5.2 Baseline



*The use of environmental technologies calls that are implemented in housing developments, through the Green Mortgage program (Source: mundopositivo.com.mx)*

Currently there are three main legislations that set the baseline that structures the sustainable building policy framework in the country, with a special orientation towards the social housing sector: Law for the Sustainable Use of Energy, the Housing Law and the Climate Change General Law. The NSSH was developed under this legislative framework in order to integrate policies, strategies and programs to promote sustainable building parameters as new construction paradigms. Furthermore, the Transversal Working Group on Sustainable Housing was constituted for a better coordination between actors and the development and implementation of the NSSH 2013.

On the other hand, up to January 2014 there are 342 LEED projects registered and 93 of them that have been LEED certified (USGBC, 2014). In absolute terms, the amount of registered LEED certified projects in the country is minimum in contrast to the volume of regular construction projects. However, the incorporation of the LEED rating system into the Mexican market has had a transformative effect; some model projects have been catalysts of a new dynamic in national markets, such as the real estate, materials and construction services markets. Currently most of the new (large scale) commercial building projects, located in the Reforma Avenue Corridor and other high-prestige zones in Mexico City, seek to obtain the

LEED Certification; it has become an appealing commercial certification for developers and investors for all types of projects: commercial, industrial, residential, institutional, mixed uses, etc. (CMES, 2014).

Finally, Mexico is also a leader in the tourism sector and now a Latin American pioneer in the sustainable tourism sector. There are currently 28 certified Earth Check projects and 13 projects with a Green Globe certification. To reinforce Mexico's commitment to sustainable tourism, the Ministry of Tourism and the Earth Check organization signed a cooperation agreement for the development of the S Distinctive for national tourist developments, which will be financed through special incentives. To achieve the S Distinctive, companies can finance up to 85 % of the certification's cost through the PYME (small and medium company) fund of the Ministry of Economy.

<sup>5</sup>EarthCheck is an international certification organization that validates carbon reduction and environmental footprint of the tourist industry, guiding their sustainability initiatives.

<sup>6</sup>Green Globe is a certification program for sustainable tourism.



## 5.2.1 Policies, Laws, Decrees and Norms

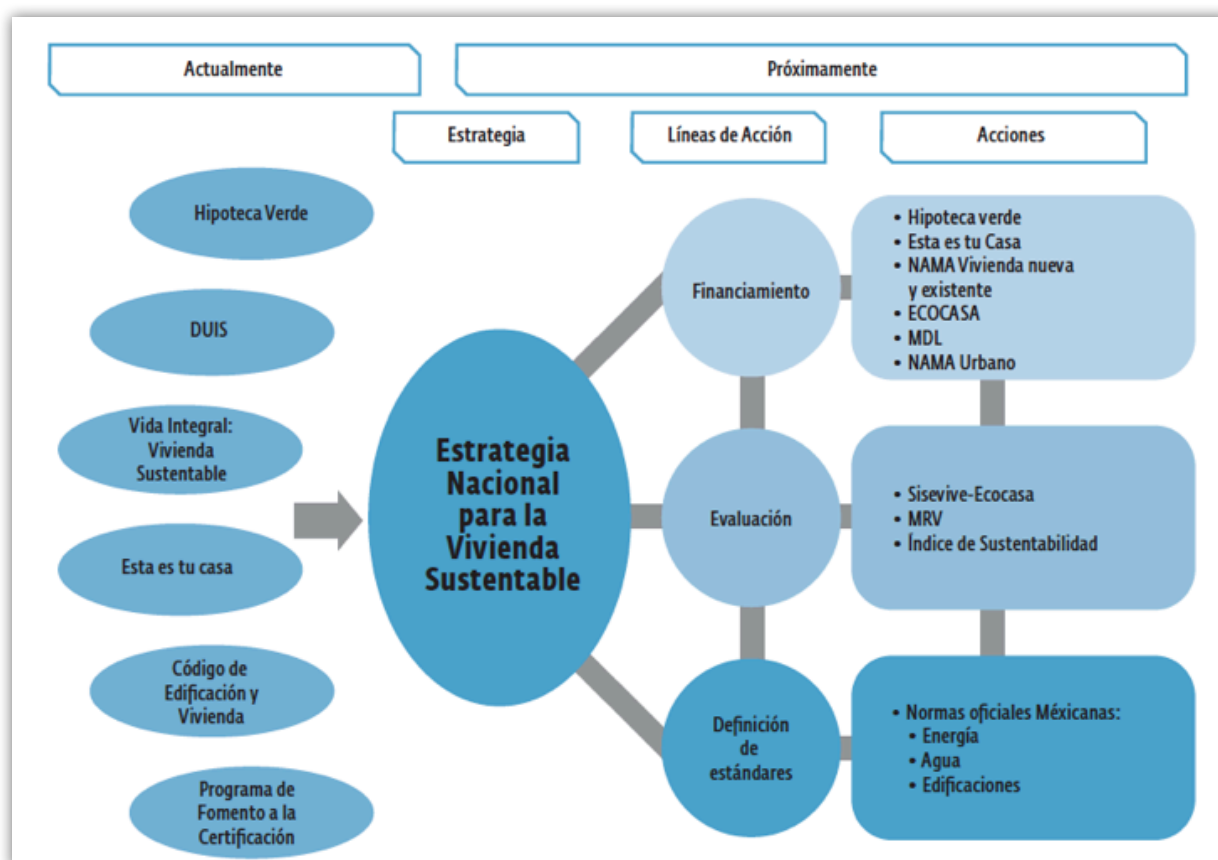
The NSSH is an institutional planning instrument that aligns national programs and strategies, such as the Special Program on Climate Change, the Transversal Program on Sustainable Housing, the National Program for the Sustainable Use of Energy, the Sectorial Energy Plan, and the National Development Plan 2007-2012, with the objective of obtaining more benefits from the programs and incorporate them into a national integrated strategy (ENVS, 2013).

The NSSH sets short, medium and long-term objectives for sustainable social housing programs that are currently in place (Green Mortgage, DUIS, Integral Life program, etc.) and it establishes three main action strategies:

- 1) Funding – Programs and mechanisms to obtain national and international funds that promote sustainable buildings.
- 2) Dwelling evaluation- Development of evaluation programs that monitor the environmental performance of houses and the results obtained.
- 3) Standard definition – Guidelines that establish the regulatory framework for the development of sustainability programs (official technical standards).

Figure 5.1 shows the NSSH diagram, which describes the strategic actions for the current established programs.

Figure 5.1 "Diagram of the National Strategy of Sustainable Social Housing" (ENVS, 2013., pg. 95)





- The Law for the Sustainable Use of Energy (DOF 28-11-2008) was published in 2008 and promotes the sustainable use of energy through its optimal use in all of its processes and activities. It designates the Energy Secretariat (SENER, for its acronym in Spanish) as the organization for energy efficiency policy decisions and it entitles the National Commission for the Efficient Use of Energy (CONUEE for its acronym in Spanish) the execution and supervision of energy efficiency measures, programs and projects (Ley 2811, 2008).

Regarding building energy efficiency, the SENER and the CONUEE have developed a technical standard to define the minimum performance requirements for the building envelope of residential and non-residential buildings, a norm for thermal conditioning, and energy efficiency norms for appliances and equipment (SENER, 2010).

There are more than 50 energy efficiency and water management norms available. Some of the energy efficiency technical norms for buildings, published by the SENER (2010) are presented:

- NOM-007-ENER-2004 – Energy efficiency lighting systems for non-residential buildings.
- NOM-008-ENER-2001- Energy Efficiency in buildings, building envelopes and non-residential buildings.
- NOM-009-ENER-1995 – Energy efficiency in industrial thermal insulation.
- NOM-011-ENER-2006 – Energy efficiency for central and individual air conditioning systems.
- NOM-018-ENER-2011- Thermal insulation for buildings. Characteristics, limits and test methods..
- NOM-020-ENER-2011 – Energy efficiency in buildings, building envelope for residential use.
- NOM-021-ENER/SCFI-2008 – Energy efficiency, user security requirements in room air conditioning systems.
- NOM-023-ENER-2010 – Energy efficiency in divided and free discharge air conditioning systems without air conducts.
- NOM-24-ENER-2012 – Thermal and optical characteristics of glass and glass systems for buildings.
- The Housing Law was enacted in 2006 and establishes national policy guidelines for the development of social housing, including sustainability components, coordination among institutions and private-public relationships (ENVS, 2013). In its sixth article, the law establishes sustainability guidelines such as the establishment of mechanisms to procure environmental care and the efficient use of energy and natural resources (Ley 2612, 2006).
- The General Climate Change Law contemplates, among other things, the following: the implementation of national goals to mitigate GHG emissions (30 % of GHG emission to 2020 and 50 % to 2050); establishment of a new institutional framework that promotes the integration between government, civil society and the private sector in the three levels of government, and adaptation to climate change measures (LGCC, 2012 cited in ENVS, 2013).

In 2013, Mexico took a major step towards achieving a greener building industry with the approval of the Federal Norm NMX-AA-164-SCFI-2013, Sustainable Building –Criteria and Minimum Environmental Requirements. It is a voluntary technical norm that is applicable in the federal level and is part of the key National Sustainable Strategies established on the NDP of 2007-2012. It proposes a series of criteria and minimum environmental requirements and establishes an indicator system to measure the levels of sustainability of buildings in Mexico (NMX-AA, 2013). The indicator system is divided in the following categories: Land, Materials, Waste, Landscape and Biodiversity, and Social Responsibility *ibid*. The state's next step to implement the technical standard is to establish incentives such as tax reductions, immediate authorization of construction permits and discounts on municipal services.

It is worth highlighting that at the local level, building codes are under the authority of each municipality, and only 72 of the almost 2,500 municipalities have a local construction code. When local building regulations have not been established, municipalities adopt the applicable state legislation. In this sense, the approval of the federal technical norm of sustainable building provides municipal authorities a reference standard that can be applied locally.

Some local governments have developed their own code and incentives to promote buildings with an exemplary sustainability performance. An example of this is the Financial Code of the Federal District, which in its articles 293 and 294, establish incentives to promote green building at the local level. It determines that house owners that implement eco-technologies are candidates for obtaining a tax reduction of up to 20 % on the rights to water supply. The code also grants incentives to companies and organizations that have implemented official and verifiable environmental programs. Such companies are candidates to obtain a discount on salary taxes, which go from 30 % to 60 % of tax reduction.

Similarly, the municipality of Zapopan, in the state of Jalisco, is a national example of local incentive schemes to promote sustainable buildings. The scheme is valid from 2012 to 2015 and includes incentives for building projects that obtain the LEED certification, developments under the DUIS scheme and social housing developments that incorporate sustainability criteria. The municipality grants buildings with a LEED certification, a 100 % discount on several tax and service incentives that include: property tax, patrimonial transference, urbanization license, construction supervision, lot approval and designation, and construction and demolition license, among others (GMZ, 2012). The municipality also offers 30 % discount on the same taxes and services for the DUIS and housing developments that incorporate sustainability criteria.

On the other hand, currently, federal incentives to promote sustainable building practices mainly focus on incentivizing the use of renewable energies. Companies that generate renewable energy and maintain its operation for at least five years can deduct 100 % of their investment from their income tax payments in the period of one fiscal exercise. Furthermore, in 2005 the government of the Federal District enacted a compulsory norm (NADF-008-AMBT-2005), applicable to local companies with more than 51 employees, that mandates companies to install thermo solar panels for water heating and to produce at least 30 % of their annual energy consumption. As a collateral result, Mexico City registers 743 green roofs that have contributed to the reduction of approximately 441 tons of GHG.

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<sup>7</sup>he payroll tax or ISN is a state tax on the making of payments of money by way of remuneration for work.

## 5.2.2 Institutional Programs

### Energy Efficiency

- **Green Mortgage Program**

The Institute of the National Housing Fund for Workers (INFONAVIT, for its acronym in Spanish) is the federal agency responsible for granting credits for the acquisition of houses. Mexican employers must offer INFONAVIT's benefits to their workers, so they can have access to credits that allow them to purchase a home. In 2007, Mexico was an international pioneer with the development of the credit program, Green Mortgage, which grants an additional credit to users that want to acquire a house with energy and water efficient equipment (ENVS, 2013). The program has diverse credit schemes, which vary according to the dwelling's climate zone. The schemes include: efficient light bulbs, solar heaters, roofs with thermal insulation, high-efficiency air conditioning and heating systems, efficient faucets and showers heads, and double discharge WCs, among others. Dwellings with these characteristics are priced in a range between \$12,000 and \$16,000 USD. The program received an award from the United Nations Development Program as the best practice for the implementation of solar heaters in 2011.

The program constantly transforms and improves; with the awareness that the most efficient houses initially contemplate an adequate design and selection of materials, the government has developed a subsequent stage that consists of the development of a program that monitors the energy and environmental performance of the house in an integral way, considering its location. Such instrument is the Evaluation System of the Green House (SISEViVe- Ecocasa for its acronym in Spanish).

- **Evaluation System of the Green House (SISEViVe - Eco casa)**

In 2012 INFONAVIT developed SISEViVe-Ecocasa as an indicator to measure the energy performance and environmental impact of dwellings, and as an additional form to impulse and focus incentives and resources destined for sustainable housing initiatives. The evaluation system is based on parameters such as bioclimatic design on buildings, constructive systems, material characteristics and implemented eco-technologies. Energy demand, water and energy consumption, and sustainable characteristics are measured through these indicators.

SISEViVe- Ecocasa is an inter-institutional evaluation tool that integrates and supports the diverse sustainable housing initiatives being carried out by different institutions (ENVS, 2013). It is used to confirm evaluation criteria and to support the decision-making processes in topics such as incentives and housing programs that consider energy efficiency, comfort and environmental friendly aspects *ibid*. The development and implementation of the system has been carried out under the framework of the program of Sustainable Energy in Mexico, for which the British Embassy in Mexico and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) have provided advice to the INFONAVIT for the development of the calculation tools involved in the energy performance and water consumption evaluation system (ENVS, 2013).



First Tangancicuaro sustainable housing, Michoacan, Mexico. (Source: [transformacionmovimiento.wordpress.com](http://transformacionmovimiento.wordpress.com))

- **Clean Development Mechanism (CDM)**
- **Sustainable Housing NAMA**

The United Nations has established the CDM as a carbon certificate market instrument to be implemented in emergent countries. Mexico registered the Specific Program for Sustainable Housing Development to face of Climate Change, as a CDM Activity Program to serve as an umbrella program for specific related projects. The initiative is coordinated by the National Housing Commission (CONAVI, for its acronym in Spanish) and it's based on the Green Mortgage and the This is Your House programs. Mexico is working on the transition from the CDM Activity Program scheme, towards the NAMA scheme.

In 2012, under the framework of the Mexico-Germany Program for NAMA of the World Bank, the GIZ provided the CONAVI with technical assistance for the development of the first NAMA for the social housing sector. It consists of an innovative approach for Mexico, as the program seeks the global performance of the house, considering a complete energy efficient performance for the housing unit (ENVS, 2013). The NAMA intends to mitigate emissions from the housing sector, by providing additional financing to improve energy efficiency and to reduce water and fossil fuel consumption, which is achieved with the use of eco-technologies, improvements in the architecture design and the use of efficient construction materials (CONAVI, 2012). Three different performance standards are proposed: the Eco House 1, Eco House 2 and Eco House Max for the main bioclimatic zones in the country (ENVS, 2013).



## Sustainable Building

- This is Your House program**

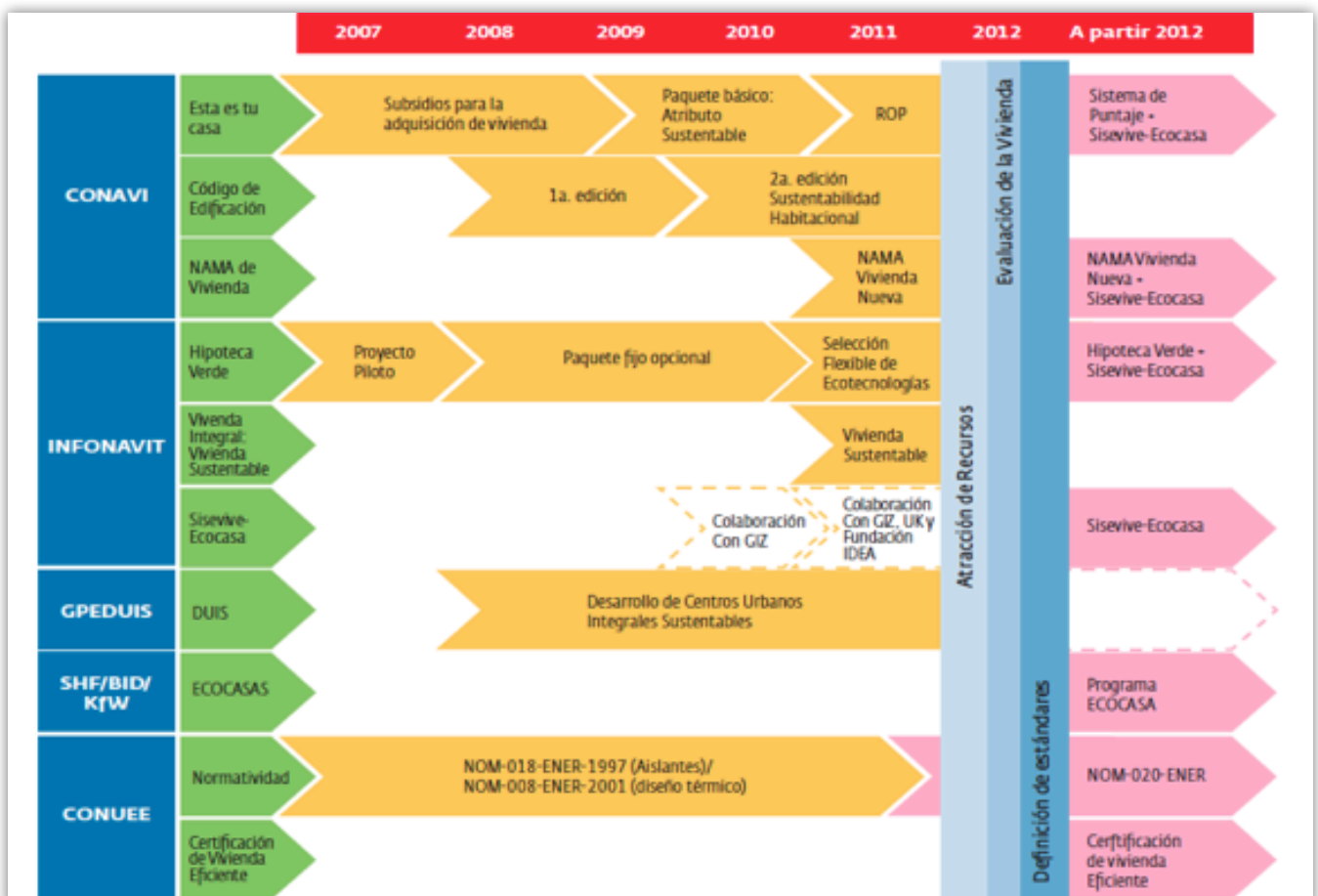
Since 2007 the CONAVI implements this program that allows the lower-income population to have access to a house, by granting subsidies for the purchase of a new or used home, to buy a lot for construction, or to rehabilitate existing houses. In 2009, for the first time, the program incorporated sustainability parameters that consider five categories: site analysis, efficient use of energy and water, waste management, and equipment and installation maintenance. In 2012 new operation rules were created for subsidy granting, which consider location, equipment, densification and competitiveness.

- Sustainable Housing Building Code**

In 2007 the CONAVI published the Sustainable Housing Building Code under the framework of the Housing Law, which mandates the development of legal dispositions, official norms and construction codes and guidelines (CONAVI, 2010 cited in ENVIS, 2013). The code has the objective of setting up a normative model that can be used by authorities of the different levels of government, to implement homologated sustainable building practices. The second edition of the code was published on 2010, establishing the following objectives:

- 1) to provide local authorities with a tool to regulate constructions;
- 2) to directly integrate construction updates and available technologies for each bioclimatic zone;

Figure 5.2 Action chronology of sustainable actions in the social housing sector (ENVIS, 2013, pg. 70).



3) to have product standards in order to promote a greater market competitiveness and

4) to promote the construction of environmentally sustainable housing that reduces negative environmental impact (ENVS, 2013).

- **Integrated Sustainable Urban Developments (DUIS for its acronym in Spanish)**

Integrally planned development areas that contribute to states' and municipalities' zoning planning initiatives and promote ordered, dense, equitable and sustainable urban developments (DUIS, 2014). It is the result of a transversal strategy that integrates initiatives from the different levels of government, in alliance with the private sector. Those who intend to develop a housing project with the DUIS recognition must present the project to an evaluating committee, which is integrated by different government agencies that will consider 83 parameters and criteria, integrated in 11 determinants, 23 pre requisites and 48 indicators in order to approve the project (ENVS, 2013).

- **Sustainable Building Certification Program (PCES for its acronym in Spanish)**

The government of the Federal District developed the PCES in 2008 to offer fiscal incentives such as discounts in property taxes and construction licenses, to local buildings that obtain between 21 and 100 points of the required criteria for the development of new buildings and the operation of existing ones. The point categories are: energy, water, solid waste, life quality, social responsibility and environmental impact. The Sustainable Building Promotion Committee, integrated by several local government agencies, is responsible for the evaluation of building projects. Currently the program has certified 3 projects and 35 that in the process of being certified.

It's worth mentioning that there are a number of sustainable building actions and programs in place, especially programs oriented towards the social housing sector. Figure 5.2, presented in the National Strategy of Sustainable Building 2013, shows a chronology of the actions that have taken place in the social housing sector.

## 5.2.3 Research Organizations

- **Business Association for Energy Savings in Buildings**

It's a public-private organization established on 2003 that works to increment the market size of their partners' products and services, by positioning building energy efficiency as the most viable solution for GHG and climate change mitigation, and to ensure the energy supply in the country (AEAAE, 2014).

- **CEMEX-TEC Center for the development of sustainable communities**

In a strategic alliance, CEMEX joins efforts with the Monterrey Tech Institute to establish the CEMEX-TEC center for the development of sustainable communities. The center's activities include the Sustainable Community Development Cathedra, multi sectorial projects of sustainable communities and the CEMEX- Tec Transforming Cities award, focused on urban and rural sustainable regeneration projects.

- **Mario Molina Center for strategic studies about energy and environment**

Dr. Mario Molina, Nobel Prize of Chemistry, founded the Mario Molina Center in 2002. Since its foundation, the center has participated in key green building research projects in Mexico. In 2006 and 2007 they collaborated with the North American Environmental Cooperation Commission to develop the report, Institutional Strategies to promote Sustainable Building in North America: the Mexican Case. In 2012 the center published the Sectorial Study of Sustainable Building, for which they developed 29 energy diagnoses in 4 climatic zones in the country. In that same year, they published the results from the research Sustainability Evaluation of Housing in Mexico, which was of relevance for the development of the Housing Sustainable Index and its Environment.

- **North American Commission for Environmental Cooperation (CEC)**

Governments from Canada, the United States and Mexico formed the CEC with the aim of addressing environmental issues under the context of the North American Free Trade Agreement. The commission has developed research reports on environmental issues, which have been presented to the governments of the three countries. One of their highlighted reports, Sustainable Building in North America: Challenges and opportunities, was published in 2008. The CEC also actively participated in the development of the Mexican Sustainable Building norm.

- **Mexico Green Building Council (MGBC)**

MGBC, founded in 2005 was the first Latin American Green Building Council. Its mission is to promote a sustainable built environment in the country, by building the technical capacities and promoting sustainable building practices, such as the LEED certification rating system.

In 2010, in collaboration with the Monterrey Tech Institute, the World Green Building Council and UNEP-SBCI, they organized and hosted the International Green Building Congress for the Americas, where eight Latin American countries shared their green building public policy experiences.

- **Mexican Institute of the Intelligent Building (MIIB)**

It was founded in 1991 as a civil organization and represents the Building Owners and Manager chapter in Mexico. Among their key activities are to provide green building technical capacity building to professionals in the construction sector and the organization

of the Jorge Martínez Anaya Award, to the Intelligent and Sustainable Building, which has been granted for the past 19 years. The MIIB also collaborated in the development of the Mexican Sustainable Building Norm- Minimum Environmental Criteria and Requirements.

- **ITESM- National Sustainability Legacy**

Through the National Sustainability Legacy, the Monterrey Tech Institute collaborates in research activities that impact the current state of sustainable building. An activity of the legacy has been the contribution to the development of the Mexican Sustainable Building Norm- Minimum Environmental Criteria and Requirements.

- **SUME (Sustainability for Mexico)**

SUME is non-profit organization with the vision of joining efforts to achieve a more sustainable country and the aim to improve the quality of life of the population, through joint actions. Among their objectives are to be a consulting source to public administrations that want to promote green building along their jurisdiction, and to implement an adequate certification system for sustainable building projects (SUME, 2013).

- **UNAM – Investigation Center of Housing and Urban Sustainable Development**

In 2013, the National Autonomous University of Mexico (UNAM) joined efforts with the Mexican Chamber of the Construction Industry and the INFONAVIT to create the Investigation Center of Housing and Urban Sustainable Development. The center focuses on developing research studies on housing and urban sustainable development; on strengthening INFONAVIT's internal capacities so they can effectively face the challenges posed by mortgage financing, and on improving the competitiveness of Mexican cities (UNAM, 2013).



Panoramic Image of the city of Mexico. (Source: betazeta.com)



## 5.3 Case Studies

- **Mexican-German NAMA Program, Housing Component**

The Nationally Appropriate Mitigation Actions (NAMA) are instruments oriented to the mitigation of GHG emissions. Mexico selected the urban social housing sector to implement the instrument with international funding. In 2011, the GIZ joined efforts with CONAVI and the Ministry on Environment and Natural Resources (SEMARNAT, for its acronym in Spanish) to create the reference framework of the NAMA for sustainable social housing projects in Mexico. The project not only focuses on the implementation of energy efficiency technologies, but also on a holistic view of sustainable building.

The GIZ developed three models of sustainable social houses for Mexican developers: Eco House 1 (similar energy efficiency levels to Green Mortgage program), Eco House 2 (higher levels of energy efficiency) and Eco House Max (minimum heating and cooling demand). Currently, co-financed pilot projects are being implemented in order to test the NAMA concepts, to refine the designs and to demonstrate their feasibility. In 2012, 4,600 houses were built in 11 cities, out of which 80 % are models of Eco Casa 1, 15 % of Eco Casa 2, and 5 % are models of Eco Casa Max. Similarly, in collaboration with the Mario Molina Center, the GIZ developed a field study to determine the baseline design of a NAMA for existing houses in 34 housing developments in the metropolitan zones of Guadalajara, Monterrey and Valle de Mexico.

Furthermore, a NAMA office has been established in Mexico to coordinate activities that promote future developments of NAMA.

*EcoCasa Housing program in Mexico. (Source: ec.europa.eu)*



- **ZEH Zero Energy Houses Mexico**

This program began its activities in Mexico in October 2009. The institutions that support this initiative are the Business Association for Energy Savings in Buildings, Environment Canada, SEMARNAT, INFONAVIT, CONAVI, NAIMA and Renewable Energy and Efficiency Partnership, among others. Between 2010 and 2011, talks and workshops of model projects that studied energy demand on houses took place. The model projects were located in developments in Acapulco, Cancun, Coatzacoalcos, Mexicali and Playa del Carmen. Results show that the energy performance of the houses can improve up to 24 % by implementing measures like double wall insulation, double-glazing in windows and improved airtightness, among others. Results of this program incentivized Mexican developers such as ARA and VINTE to develop 88 new houses under these criteria.

- **Integrated Sustainable Urban Developments (DUIS) of the Federal Mortgage Society (FMS)**

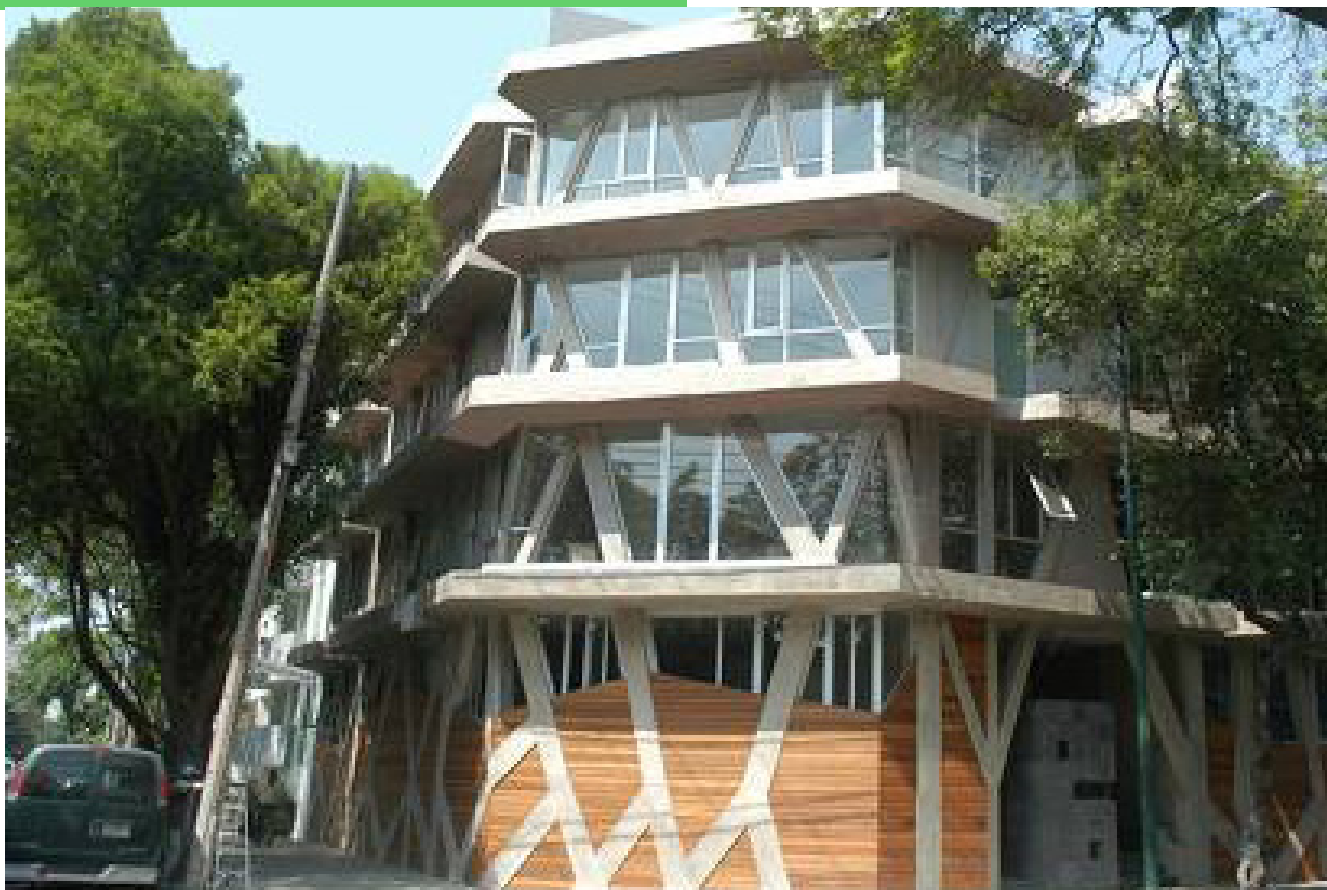
The FMS developed the DUIS as an inter-institutional strategy to promote integrally planned areas at the regional, urban and local levels. Urban developments that achieve sustainability requirements through the rational use of resources and the implementation of technologies to save water and energy, are candidates to apply for certification granted by the Integrated Sustainable Urban Development Promotion and Evaluation Group. The national institutions that are part of the DUIS group include BANOBRAS, FONADIN, FOVISSSTE, INFONAVIT, SEDESOL, SEMARNAT and SENER. After approval, the urban development project has access to a great variety of incentives from local and federal authorities.

To date, there are 12 DUIS certified projects in Mexico, which is equal to 420,028 houses for 555,154 people. Similarly, there are other 4 projects in evaluation process and other 10 in the pre-evaluation process. A DUIS project that has already been implemented is the urban regeneration in the Historic Center of Puebla.



*One of the areas of the historic center of Puebla is part of the regeneration that is already underway.  
(Source: obrasweb.mx)*

## 5.4 Future Actions



*Environmentally friendly development in Mexico city. (Source: Archello.com)*

Mexico has achieved significant progress in the green building sector, where the cross-sectorial collaboration of agencies, the private sector and international cooperation initiatives have been a key factor for the development and refinement of the green building regulatory frameworks and the implementation of the actions established in them.

The NSSH 2013 is a clear indicator of the orientation green building national public policy is taking; it establishes that social housing represents a key sector to address social development needs, and at the same time it represents a means to facilitate the achievement of the mitigation and adaptation to climate change goals the country has set. In this sense, the states main future actions consist of the development of the mechanisms (incentives, programs, alliances, etc.) through which the main dispositions established in the NSSH will be implemented.

Considering the previous context and future actions established in the NSSH 2013, the following recommendations are proposed:

- Development of capacities and resources at the local level for the implementation of national green building strategies.
- Promote the Sustainable Housing Building Code, developed by the CONAVI, in the municipal level and provide technical support for the development of policies and local incentives for its implementation.



- In addition to the incentives established to promote the implementation of eco-technologies, extend federal incentives to cover broader sustainable building practices such as bioclimatic design and water and waste management systems, among others.
- Development of a general green building national strategy that includes the residential, commercial and public sectors.
- To adequate evaluation mechanisms such as the SISEVivE- Ecocasa to be applied to non-residential buildings.
- Development of a labeling system that contains detailed information such as percentages of electric energy and water savings, information about the efficiency of the building envelope, level of GHG projected emissions, an approximation of projected savings in electricity, gas and water, and the level of compliance with the sustainable building and energy efficiency technical norms.
- Development of financing programs and mechanisms for the commercial and industrial building sector.

## 5.5 Lessons Learned

Mexico has achieved great progress in the development of policies that conform the baseline of the sustainable building regulatory framework. Such is the case with the General Climate Change Law, which mandates and legally binds states and municipalities to create policies and actions towards climate change mitigation and adaptation.

The law also sets national GHG reduction goals of 30 % for 2020 and in 50 % for 2050. The Housing Law mandates the incorporation of sustainability elements in the social housing sector and the Law for the Sustainable Use of Energy (DOF 28-11-2008) has the objective of propitiating the sustainable use of energy by its optimal use in all of its processes and activities, including building construction and operation.

As with most Latin American countries, in Mexico, energy efficiency represents a central strategy in the construction of national sustainable building policies and actions. Technical standards that set the minimum requirements for insulation systems and energy efficiency for the building sector derive from the Law for the Sustainable Use of Energy, these address both the residential and non-residential sectors.

Furthermore, federal incentives to promote sustainable building are generally more focused on promoting the use of renewable energies. An example of this is the incentive to deduct 100 % of the company's investment from their income tax payments, in the period of one fiscal exercise, granted to companies that produce renewable energy and maintain their production for 5 years.

Mexico stands out from the rest of the Latin American countries for the development of their National Strategy for Sustainable Housing. It's a planning instrument that aligns national strategic plans such as the Special Program on Climate Change, the Transversal Program of Sustainable Housing, the National Program for the Sustainable Use of Energy, the Sectorial Energy Program and the National Development Plan of 2007 -2012, with the objective of making all implemented programs more efficient and aligning them into an integrated national strategy.

The strategy formulates short, medium and long-term objectives for the currently implemented social housing programs; in the short-term it establishes strategic actions for the development of financing mechanisms, program evaluation systems and development of technical standards (official energy, water and building norms) in order to promote sustainable housing. In the long-term the strategy seeks to promote a profound transformation in the way in which houses and housing developments are built (ENVS, 2013).

The country not only stands out for innovating in the creation of green building planning instruments, they also excel in the development and execution of institutional programs that incentivize building energy efficiency and green building practices. The program Green Mortgage and the Evaluation System of the Green House (SISEViVe - Eco casa) have become models at the international level of financing mechanisms to fund energy efficiency and green building solutions for the social housing sector.

Also, programs developed under the context of Clean Development Mechanisms and the NAMA are pioneering programs, where for the first time the social housing sector has been included.

The NAMA intend to mitigate emissions from the housing sector, by providing additional financing to improve energy efficiency and to reduce water and fossil fuel consumption, which is achieved with the use of eco-technologies, improvements in the architecture design and the use of efficient construction materials. Furthermore, other successful programs such as DUIS, PCES, This is Your House and ZEG Zero Energy Houses Mexico have been established to promote green building practices.

Regarding available instruments for the implementation of best building practices, there are a series of energy efficiency technical norms that set minimum building standards (energy efficiency standards for building envelope -residential and non-residential- thermal insulation, refrigeration and lighting, among others). Also, progress has been made in green building with the recent publication of the technical norm Sustainable Building – Criteria and Minimum Environmental Requirements, which sets voluntary sustainability criteria and minimal environmental requirements and establishes an indicator system to measure the levels of sustainability of constructions in Mexico.

Finally, voluntary certification tools such as LEED, Earth Check and Green Globe have served as catalyzers in the private sector, where a certified building has become an added value and an attractive form of investment.

Some of the future recommendations are capacity building in the local level for the implementation of the National Strategy of Sustainable Housing and the Sustainable Housing Building Code. Also, considering that Federal incentives mostly focus on promoting the use of renewable energies, it is recommended to extend them to cover broader sustainable building practices, such as bioclimatic design and water and waste management systems, among others.

Also, in addition to the National Strategy of Sustainable Housing it is recommended to have a general green building strategy for the residential, commercial and public sectors, with the objective of having an integral strategy in all building sectors.

Finally, it is recommended to adapt evaluation systems such as SISEViVe-ecocasa to the non-residential sectors and the development of financing programs and mechanisms for these sectors.

# Peru





## 6.1 Context

According to the National Institute of Statistics and IT, on 2013 the republic of Peru had a population of 30,475,144 inhabitants (INEI, 2013). It is the eight largest Latin American economy, with a registered annual GDP growth rate of 6.3 % in 2012. (Banco Mundial, 2014). 76 % of the population lives in urban areas, whereas 30 % of the urban population lives in Lima, the country's capital (SCN, 2010). It's a unitary republic with a decentralized and representative government, divided in 25 provinces and 439 districts (GEP, 2014).

The political constitution declares the State as the responsible entity to promote environmental conservation and sustainable development in the country and the Amazon (PNA, 2009).

Peru is part of the UNFCCC agreements since 1992 and signed the Kyoto Protocol on 2002; also, since 1992 the government has implemented strategic national climate change actions (SCN, 2010), some of the most relevant are: the approval of the National Climate Change Strategy (NCCS) in 2003; creation of the Law (No. 28245) for the Environmental Management System for the coordination and implementation of the agreements established in the UNFCCC; the promulgation of the General Law of Environment in 2005 and the development of the National Environmental Policy in 2009; enactment of the Energy Efficiency Law in 2007; the founding of the Ministry of Environment in 2008, and finally, the approval of the Climate Change Scientific Research agenda in 2009 (MA, 2014).

In addition, a Climate Change National Commission has been created and is composed by 7 technical groups that work on topics such as mitigation, Clean Development Mechanisms, research and technology, and climate change adaptation *ibid*.

InterCLIMA is a relevant initiative lead by the Ministry of Environment that promotes an annual platform of encounter and experience exchange, oriented towards national climate change management (MA (a), 2013). The event facilitates the articulation of initiatives, experience exchange, strengthening of institutions and knowledge management among government actors, civil society and international experts, with the purpose of positioning Peru in the international arena, as a progressive nation in climate change management.

Some of the main objectives of InterCLIMA 2013 were: to generate a better understanding of Low Carbon Development; to share the achieved progress, challenges and opportunities in climate change; to provide a space for capacity building and learning for Peruvian professionals; establish collaboration and experience exchange mechanisms with Latin American and International countries, and to begin the process of developing the Roadmap for emission management in the country *ibid*.

The national GHG emission inventory was recently updated and it was determined that from 2000 to 2009, GHG emissions increased about 15 %, mainly due to the growth in multiple industries such as the automotive industry and due to an increase of solid urban waste, among other causes (PLANCC, 2009). Based on these inventories, it is determined that the energy sector contributed 28.2 % of the total CO<sub>2</sub> emissions produced between 2000 and 2009, being the second sector with most emission production *ibid*.

Peru addresses the achievement of building sustainability, mainly through wastewater and solid waste management practices, and energy efficiency solutions. The Strategic National Development Plan, Plan Peru 2012, sets six strategic national development pillars to the year 2021. The sixth pillar is: Natural Resources and Environment, which establishes as an objective the conservation and sustainable use of natural resources and biodiversity and an environment that propitiates the population's quality of life and the existence of long-term healthy, feasible and functional ecosystems (PEDN, 2010).

This pillar sets 22 policy guidelines, from which 5 of them are consider to be of priority:

- 1) Sustainable use of natural resources.
- 2) Improvement of the environmental quality (air, water and land).
- 3) To ensure water supply in all of the territory.
- 4) Climate change adaptation, and
- 5) implementation of the National Environmental Management System (PEDN, 2010). Similarly, the National Climate Change Strategy establishes as one of its main objectives, to manage GHG emissions and other air pollutants through action lines such as energy efficiency, air quality improvement and the use of renewable energies (ENCC, 2002).



*Cover: Formal Construction - District San Isidro (Source: Peru GBC)*

*On this page: The Tambo del Inka, a Luxury Collection Resort & Spa is the only one in Peru to have received LEED certification. (Source: Peru GBC)*

The construction sector is a key pillar in the country's economic development, representing 5.9 % of the national GDP and presenting growth rates of 8.4 % in 2005 and 16.5 % in 2008 (SCN, 2010). Moreover, the Ministry of Housing, Construction and Sanitation foresees that an expansion of 15 % will be maintained towards 2015 (APN, 2013).

However, it's important to consider that Peru presents a housing deficit of approximately two million houses (of which about 20 % corresponds to a quantitative deficit), with an annual growth rate of 100,000 units per year, which can be translated to a shortage of more than 400,000 houses (Gutiérrez et al., 2010). Qualitative housing deficit refers to existing houses that have inadequate physical characteristics and/or are located in overcrowded locations; these ascend to over 1,242,321 housing units (MVCS, 2008).

Most of the housing demand is concentrated in the low and middle-income segments of society, which means that social housing has great potential for this market (Gutiérrez et al., 2010).

## 6.2 Baseline

The National Environmental Policy (NEP) is one of the main planning instruments for the achievement of sustainable development in the country and its developed under the Law of Environment (No. 28611) and other legislations such as: Organic Law of Regional Governments (No. 27867- which also establishes the development of regional climate change and biodiversity strategies); Organic Law of Municipalities (No. 27972) and the Organic Law of the Sustainable Use of Natural Resources (No. 26821) (PNA, 2009).

The National Environmental Action Plan (NEAP) 2010 -2021 is an instrument that articulates the strategic actions established in the NEP. It sets 4 main pillars and 68 strategic actions. Sustainable building is not directly included in the plan, however some of the action lines establish the structural baseline for the development of sustainable building policy, for example:

5.1.9 climate change mitigation and adaptation: reduce the GHG emissions through deforestation control and emission reduction in the industry, transport and energy sectors and development of regional climate change adaptation plans in all of the territory.

5.2.2 Water Quality: to treat and reuse 100 % of domestic wastewater by 2021.

5.2.3 Air quality: improve urban air quality through actions such as technology replacement.

5.2.4 Solid waste: to achieve adequate disposal of 100 % of municipal solid waste and implement minimization, reuse and recycling of solid waste solutions (PNAA, 2010).

The priority strategic actions established in the NEAP are:

- 7.1 Goal 1: Water
- 7.2 Goal 2: Solid Waste
- 7.3 Goal 3: Air
- 7.4 Goal 4: Forests and Climate Change
- 7.5 Goal 5: Biodiversity
- 7.6 Goal 6: Mining and Energy
- 7.7 Goal 7: Environmental Governance

The National Urban Development Plan of 2006-2015, Peru: Territory for all, aims to guide the national urbanization process considering sustainable development principles (Vega et al., 2006). One of the four pillars that composes the plan is, Sustainability and Competitiveness, which promotes the rational use of resources (land, air and water) to address the population's needs and urban activities. The plan proposes an urban development process that minimizes the use of non-renewable resources, the research and promotion of substitute resources and the rational use of renewables, without exceeding the ecosystem's carrying capacity *ibid.*

The State has had a limited intervention in the construction sector; in the eighties, the government regulated the sector to maintain stable prices of construction materials, and in the last decade they allowed the sector to be regulated by market laws, without incorporating aspects such as habitability, environment or physical security, which has significantly restricted the implementation of environmental measures in the sector (MVCS, 2008).



However, in 2012, the Metropolitan Municipality of Lima enacted the Ordinance No. 1628 that approves the Metropolitan Environmental Policy.

In its regulation No. 8.3.6 - Policy Guidelines on Strengthening the Environmental Control and Environmental Management – it establishes the promotion of eco efficiency and the adoption of environmental practices on buildings and municipal organizations (Ordenanza 1628, 2012).

Currently, the most relevant initiative from the government to incorporate sustainability in the construction sector is the Sectorial Environmental Management Plan (SEMP) 2008-2016 promoted by the Ministry of Housing, Construction and Sanitation. The SEMP sets a series of strategic actions towards 2016 that have the objective of promoting and propelling the development of sectorial activities in a sustainable manner, in order to achieve a better urban and rural environmental quality (MVCS, 2008).

The SEMP is currently in an initial stage, in relation to sustainable building policy development. This can be determined, by its overriding objectives, which are:

- 1) development of the regulative framework of the Sectorial Environmental Management Plan (e.g. development of regulations for the management of solid waste derived from construction and sanitation, among others);
- 2) establishment of control mechanisms and environmental evaluations of the impacts generated by housing, urban, construction and sanitation activities;

3) promote and increase citizen participation in sectorial activities for the improvement of environmental quality in urban and rural areas and

4) promote the sustainable use of resources linked to sectorial activities, incorporating reduction, reuse and recycling techniques (development of a technical normative framework for the promotion of housing, urban and sanitation alternative technologies) (MVCS, 2008, pg. 21).

In Peru, as in other Latin American countries, international cooperation has been crucial to the progress in the development of green building policies. In August 2013, in the context of the project, Development and Implementation of a Sustainable Housing Code in Peru, a group of representatives from the Ministry of Housing, the Building Research Establishment and other organizations, met for a panel discussion called Sustainable Housing Codes (MVCS, 2013).

The objective of the discussion was to share the British experience on the development and implementation of their sustainable building code, while the Peruvian government shared the challenges they face upon the creation of their own sustainable building code (Embajada Británica, 2013).

The project contemplates the revision of the current legislation, the national context, and an evaluation of the potential implementation of the code in the national market, and finally, the revision of international policies for the development of a basic guide that sets a model for a local sustainable housing policy (MVCS, 2013).

Another cooperation initiative is led by the Ministry of Housing, Construction and Sanitation, that is working on the research study, Development of Construction Measures and their Relation to Climate Change, financed by the Belgian Development Cooperation organization, and that will be concluded in April 2014. The objectives and stages of the study are divided as follows:

1) Diagnosis of the current building situation, considering its environmental impact and climate change exposure.

2) Current context, transition and transformation in terms of economic benefits and savings in water, energy, materials, solid waste management, and environmental and social quality improvement.

3) Short, medium and long-term actions and goals to promote sustainable building (MVCS b, 2013). Finally, the Ministry of Environment and Environment Canada, are working on the design of the National Roadmap to Achieve Low-Carbon, Sustainable Buildings for Climate Change Mitigation.

Finally, one of the available tools for the implementation of sustainable building practices is LEED certification. As of 2014, there are 88 registered projects and 8 projects that have obtained the certification (USGBC, 2014).

## 6.2.1 Policies, Laws, Decrees and Norms

- The Law for the Promotion of the Efficient Use of Energy (Law No. 27345) has the objectives of ensuring energy supply, protecting the consumer, promoting the competitiveness of national economy, and to reduce the negative impact from the use and consumption of energy (Ley 27345, 2000). In 2007, through the Supreme Decree No. 053-2007, the law regulated dispositions to promote the efficient use of energy in the residential, production, transport, transformation, distribution, commercial and energy consumption sectors (DS 053, 2007).

The government establishes the goal to reduce 15 % of energy consumption for the year 2018 and according to energy consumption levels, the priority sectors are: residential, productive, services, production and transport industries (MEM, 2009). To achieve this the Referential Plan for the Efficient Use of Energy 2009-2018 was published, which sets strategic actions to implement energy efficiency measures in the construction sector. For the residential sector, 34 energy efficiency actions are considered, some of the most relevant are:

- To establish building norms that contain criteria for bioclimatic design, considering the climatic conditions of the different zones.
- Establishment of energy efficiency labeling for buildings.
- Establecimiento de reglamentos de consumos mínimos de equipos para limitar el ingreso e equipos ineficientes o de alta demanda (foco incandescentes, duchas eléctricas u otro tipo de calentadores instantáneos)

For the public sector 26 energy efficiency actions are considered, some of the most relevant are:

- Efficient lighting – modernization of lighting equipment.
- Implementation of solar heaters.
- Institutional housing programs that incorporate the use of efficient equipment (efficient light bulbs, solar or gas heaters, etc.)
- To design and construct public premises considering energy efficiency criteria for all types of buildings that the state constructs or modifies (schools, hospitals, administrative buildings and others) and the use of available regional renewable energies.
- To create a program of energy efficient building prototypes, strengthening the program through the implementation of pilot projects and promoting the energy efficiency practices implemented in state and private buildings.
- Energy efficiency norms for building construction and restoration.

- Establishment of an energy efficiency label for buildings that consider the previously mentioned norms.

As of now, the actions established for both building sectors are still in a developing state and none of them have been implemented (FES, 2012). However, some of the energy efficiency technical standards available focus on refrigeration, solar systems, efficient lighting and water heaters (MEM, 2014).

- Sectorial Environmental Policy for Housing – R.M. No. 165-2007-VIVIENDA.
- Sectorial Environmental Management Plan – R.M. No. 118-2008-VIVIENDA.
- Environmental Protection Regulation – D.S. No. 015-VIVIENDA.
- Maximum permissible limits for wastewater treatment plant effluents – D.S.No. 003-2010
- Policy guidelines to promote wastewater reuse for the irrigation of urban public areas – R.M. No. 176-2010-VIVIENDA.
- Regulation for construction and demolition management activities - D.S. No. 003-2013-VIVIENDA.
- Resolution to approve the monitoring and quality protocol for domestic or municipal wastewater treatment plant effluents - R.M. No. 273-2013-VIVIENDA.

The National Housing Plan 2006-2015: Housing for All, and the Bicentenary Plan are the policy instruments that address housing challenges in Peru. Their main objective is housing deficit reduction, and to meet the housing demand derived from the creation of new families. To achieve this, the production of low-cost and optimal quality housing is promoted for the urban and rural areas, contributing also to poverty alleviation. The National Housing Plan seeks to generate opportunities to facilitate the access to dwellings, through housing solutions that comply with established criteria on environmental adaptation, security, structure, surface and habitability.



*Living situation in some areas of Peru. Using the National Housing Plan also seeks to overcome poverty (Source: munibelen.gob.pe).*



## 6.2.2 Institutional Programs



*Rural electrification with renewable energy in Peru. (Source: suelosolar.es)*

### Energy Efficiency

- **Eco-Efficiency Guide – Energy Efficiency for Institutions of the Public Sector**

The Guide was adopted on 2009 to comply with the Supreme Decree No. 009-2009-MINAM and its modifier Decree No. 011-2010-MINAM – Energy Efficiency Measures, as a part of the National Environment Action Plan. It establishes the environmental regulation for public institutions, which include: a) energy efficiency, b) fuels, c) water, d) office supplies and e) solid waste management (MA, 2011).

It's a strategy that allows institutions and companies to adopt measures to improve their environmental performance and at the same time produce economic benefits. Some of the energy efficiency measures implemented in institutional buildings are: determine the energy consumption baseline and energy-saving areas of opportunity; promote the modification of using habits to improve energy efficiency and the implementation of efficient technology, specifically lighting; adequate distribution of office space to leverage natural light and ventilation; optimization of working hours in order to maximize natural light use; natural ventilation optimization, rationalization in the use of artificial lighting during dark hours

and the optimization on air conditioning use. The results of the implementation of these measures will be reflected in the performance indicators, in economic benefits and in the minimization of waste and environmental impacts, which will be translated into economic savings for the State (MA, 2011).

- **NAMA – Save Energy and Save the Planet, projects 1, 2 and 3**

of Clean Development Mechanism (CDM) projects and the National Environmental Fund is responsible for updating and promoting the CDM project portfolio and of being a focal point of the Prototype Carbon Fund of the World Bank (MA a, 2014). Up to 2013 there were 86 national projects with a national letter of approval, from which 53 are in the registration stage and 13 of them are currently receiving Certified Emission Reductions (MA, 2013). Of these, five are renewable energy projects.

The project, Save Energy and Save the Planet 1, consists on the substitution of conventional incandescent lamps for fluorescent lamps in houses.

The objective is to install approximately 537,641 lamps in homes that are located within the electric energy distribution network

## Sustainable Building

- **Environmental Certification**

of the company Hidrandina, in the regions of La Libertad, Anacash and Cajamarca, located in the north of Peru (MA b, 2014). All of the homes that are registered as clients of Hidrandina are eligible to participate in the project, which is valid from 2010 to 2016, and estimate an approximate accumulated reduction of 129 766 Tn Co<sub>2</sub> e *ibid*.

The projects 2 and 3 have the same objectives, but they have different locations and different numbers of lamps to replace. Project 2 projects a reduction equivalent to 128 207 Tn CO<sub>2</sub> e, from 2010 to 2016 and estimates the substitution of 531,182 lamps homes in the concession of the companies Electronorte, Electro Centro, SEAL and Electro Sur, in the regions of Lambayeque, Amazonas, Cajamarca, Pasco, Huánuco, Junín, Ayacucho, Huancavelica, Arequipa, Tacna y Moquegua (MA c, 2014). Similarly, Project 3 has the objective of substituting 521,177 lamps in the regions of Tumbes, Piura, San Martín, Loreto, Cusco, Apurímac, Madre de Dios, Ucayali y Puno (Ma d, 2014).

With the aim of complying with the Law No. 27446 of the National Environmental Impact Evaluation System, the Office of Environment of the Ministry of Housing, Construction and Sanitation, assists builders in obtaining the Environmental Certification, by facilitating the process to complete the Technical Requirements Form, and by conducting construction projects to comply with the requirements of the policy. The process to obtain the Environmental Certification consists on presenting the application, action classification, evaluation of the environmental management instrument, resolution, follow up, and control (Ley 27446, 2009).

A construction project can obtain the Environmental Certification if it complies with the following conditions: 1) The building is not located in a natural protected area or at an archeological site; 2) It attends a rural population of less than 2,000 habitants. Also, it must comply with one of the following conditions: 3) potable water with and without treatment; 4) potable water by pump with and without treatment; 5) Basic Unit of waterborne Sanitation; 6) ecologic or compost basic unit sanitation; 7) continuous composted basic unit of sanitation and 8) basic unit of sanitation in a dry ventilated hole (MA, 2013). If the building effectively complies with these requirements, the Technical Environmental Form can be registered online in order to obtain the Environmental Certificate (MA, 2013).

- **Green Roof Program**

The government of the municipality of San Miguel in Lima discounts 20 % on the parks and gardens tax to residents who install green roofs in their buildings or houses (Hoz, 2013). The Ordinance N ° 232-MDSM creates the Green Roof program with the objective of improving the air quality and recovering the house's and buildings' roofs, so they serve both an environmental and ornamental function. The objective is that buildings registered in the program initially cover at least 40 % of their roof area, and then annually increase 10 % of the green space, until they cover at least 80 % of the surface *ibid*. Furthermore, the municipality of Molina has set a decree that mandates houses and new constructions to assign at least 25 % of their roof space to vegetation.

The program San Borja+Verde incentivizes owners to turn their roofs into green roofs or gardens. Through a new local policy enacted by the Ordinance N° 496-MSB, local authorities determined that new constructions should contribute to the improvement of air quality, the increase in green areas and the embellishment of public areas. It determines that new non-residential buildings are obligated to vegetate their roofs or terraces.



*Sustainable Housing in the City of Iquitos (Source: Peru GBC)*



## 6.2.3 Research Organizations

- **Peru Green Building Council (PGBC)**

A non-governmental organization that seeks the effective and integral implementation of sustainable building practices in Peru, through education, diffusion and promotion of practices, in order to transform the way buildings and communities are designed, built and operated (CPCS, 2014). Their general objectives are: promotion of green building projects from their conceptual design, to the construction stage and during its operation; to encourage synergies among the construction industry to facilitate the establishment of a market led by the best building practices; development of a local culture that understands, values and promotes sustainable building principles; and to develop transparent procedures and policies under the concepts of equity and ethics among the members of the organization.

- **National System of Environmental Information (NSEI)**

The NSEI is an institutional and human network of technological integration that facilitates the systematization, access and distribution of the environmental information for decision-making and environmental management in the country (MA e, 2014). They seek to serve as a support for the implementation of the National Environmental Management System and the Environmental Ministry is responsible for its management. This systems presents environmental information in a systematized form and it is structured with the following research modules: environmental indicators, thematic maps, environmental library, reports on the state of the environment, environmental policy and environmental search engine *ibid*.



## 6.3 Case Studies

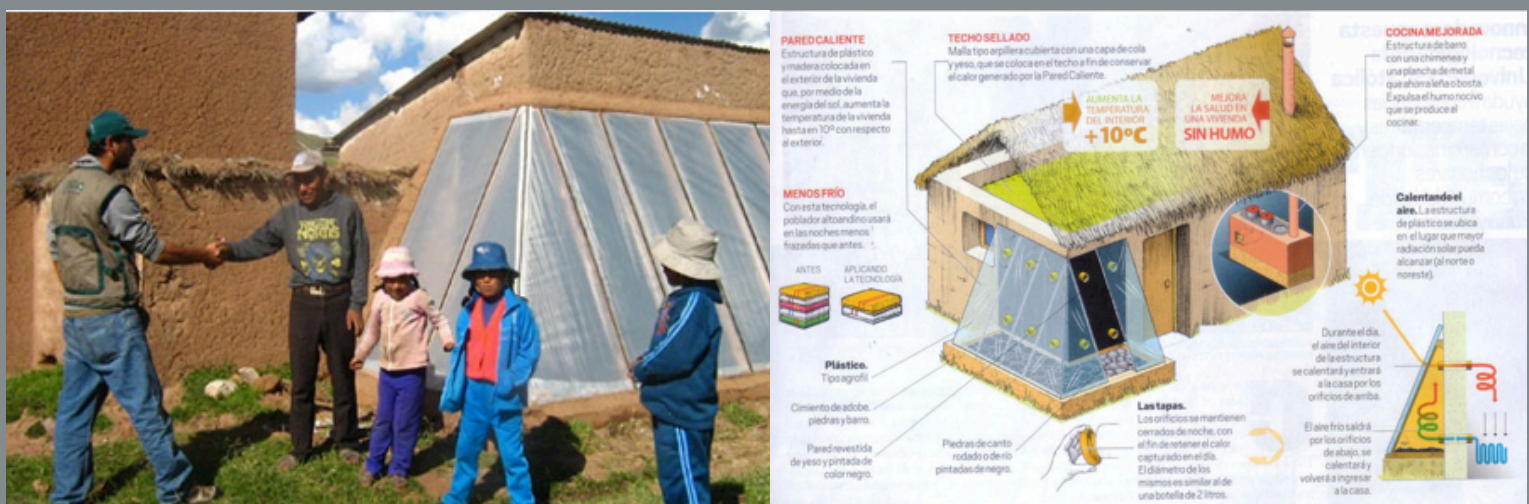
- **Hot Clean House K'OÑICHUYAWASI**

Every year more than 500 people die and over 20,000 cases of respiratory diseases are reported in the high-Andean zones of Peru (GASR, 2012). Deaths and sicknesses, which generally affect elderly people and children, are caused due to a low insulation protection against cold in houses and due to the inhalation of smoke produced by open fire cooking *ibid*.

In June 2012 the Rural Sector Support Group (RSSP) of the Pontifical Catholic University of Peru proposed the project Hot Clean House K'OÑICHUYAWAS, supported by the International Federation of Red Cross Societies, the Academic Direction of Social Responsibility and Good Works in the Name of Jesus-Christadelphian Meal a Day Fund of the Americas. The housing proposal considers appropriate technologies to solve the problem through the following technological package: a hot wall, an insulation system and an improved kitchen. Such technologies are developed with a focus of appropriate technologies that are based on the following characteristics: they are environmentally friendly because they use renewable resources and don't damage the ecosystem; they prove solution to either a productive or a domestic concrete need in an effective way; they are low-cost, easy to understand, manage and maintain, therefore they are replicable at a local scale (GASR, 2012).

The project has been implemented in the province of Cusco and has benefited more than 600 residents of the rural zones of Cusco and Puno and has also been implemented in 5 schools and 2 medical centers. Also, more than 100 people of the rural zones have been trained

Figur6 6.1 Model of Hot Clean House K'OÑICHUYAWASI (GASR a, 2014).



- **Green Roof in the Real Seis building of the Entrepreneurial Center of Real de San Isidro**

As part of the initiatives on various districts of Lima to promote the Green Roofs program, in 2013 the largest green roof in the country was installed in the Real Seis building. It has an extension of 1,200 sq. m. and has native and low-irrigation plants, an automated irrigation systems, it uses photo-catalytic paint with high solar reflection, which allows the reduction up to 30 % of heat islands in the building, provides a pleasant view, reduces the levels of contamination, and also allows energy savings (Terra, 2013).

*Figure 6.2 Green Roof of the Real Seis Building of the Entrepreneurial Center of Real de San Isidro (Terra, 2013).*



## 6.4 Future Actions

The State developed the Referential Plan for the Efficient Use of Energy of 2009-2018, where they established building energy efficiency objectives for both the residential and public sectors. However, to date, none of the actions established for the residential (34 actions) and the public (26 actions) sectors have been executed.

Some of the most important future actions are: the developments of technical standards to set guidelines for thermal conditioning and bioclimatic architecture, the development of a building energy efficiency labeling program, implementation of pilot projects of energy efficiency in public buildings, among other actions contemplated in the plan that have not yet been implemented.

The Sectorial Environmental Management Plan 2012-2016 is currently also in a development stage. It proposes the following objectives in 2016: to develop the normative framework of the Sectorial Environmental Management System; development of regulations for construction solid waste management and sanitation; creation of a normative technical framework for the promotion of alternative technologies for housing, urbanism, construction and sanitation; and to establish and conduct control mechanisms for the environmental impacts generated from housing, urbanism, construction and sanitation activities, among others.

Furthermore, the state has set the following national goals: to reduce 15 % of the energy consumption by 2018, to treat 100 % of wastewater, and to reuse 50 % of it, and to manage, reuse, and adequately dispose of 100 % of the solid waste by 2021. Also, the goals seek for cities to comply with air environmental quality standards, and for all entities that conform the National Environmental Management System, to implement the National Environmental Policy.

Finally, the Ministry of Environment and Environment Canada are in the process of designing the National Roadmap for Low-Carbon Sustainable Buildings for Climate Change Mitigation.

Given the previous context and the actions established in the Sectorial Environmental Management Plan and the Referential Plan for the Efficient Use of Energy, the following future recommendations are considered for the development of an integral national sustainable building policy. Strengthening of institutional technical capacities for the development of energy efficiency and sustainable building public policy.

To incorporate sustainable building into key environmental and planning policies such as the National Environmental Policy and its Action Plan, the National Climate Change Strategy and the Sectorial Environmental Management Plan.

To establish financing and knowledge transfer mechanisms for the implementation of the Referential Plan for the Efficient Use of Energy, which has not yet been implemented.

To highlight the importance of achieving the established goal of developing energy efficiency technical standards, which establish the minimum construction requirements of thermal conditioning, passive design, minimum energy efficiency levels and the use of eco-technologies. To integrate sustainable building in the national agenda, through the development of a transversal sustainable building strategy and a cross-sectorial committee that facilitates the interaction among the different governmental agencies.

Development and implementation of social housing programs that incorporate sustainable practices, supported by financing mechanisms, such as NAMA.

To explicitly incorporate sustainable building in the InterCLIMA annual event, which is one of the most relevant initiatives for the development of policies to promote a low-carbon economy.



## 6.5 Lessons Learned

Peru has established national initiatives that conform the structural base for the future development of sustainable building policies. These are a series of policies and planning instruments that set the initial baseline for green building public policy.

The main instrument for the implementation of environmental measures is the National Environmental Policy and its National Environmental Action Plan 2010-2021, which set national strategic action lines, such as: climate change adaptation and mitigation, water quality (it sets the goal to treat 100 % of the domestic wastewater by 2021), air quality and urban solid waste.

At the policy level, Peru has incorporated energy efficiency actions in the building sector through the Referential Plan for the Efficient Use of Energy 2009-2018 and has established the goal of reducing 15 % of energy consumption by 2018.

The Plan establishes strategic action for the residential and public sectors that include measures such as: development of a building technical norm that incorporates bioclimatic design, considering the different climatic zones of the country's regions; establishment of energy efficiency labels for buildings; efficient lighting – modernization of lighting systems; and installation of solar heaters and development of local social housing programs that incorporate the use of efficient equipment (saving light bulbs, solar and gas heaters, among others). However, little progress in the development of all these initiatives has been achieved.

The Sectorial Environmental Management Plan of the Ministry of Housing, Construction and Sanitation is a transversal strategy employed for the implementation of the National Environmental Action Plan in the housing sector. It establishes a set of actions up to 2016 that include the development of a normative framework for the construction sector, which considers environmental sustainability and promotes the adequate use of resources linked to construction activities, by incorporating reduction, reuse and recycling practices of construction materials, among other measures. Finally, the National Urban Development Plan seeks to conduct the urbanization process considering sustainability concepts for its development and promoting the rational use of natural resources.

Regarding institutional programs that promote sustainable building practices, the Environmental Certification program is the most important, given that it's a transversal program that mandates the completion of environmental requirements for the construction of public buildings.

The requirements are mostly focused on wastewater management and it ensures that construction projects are not located in natural protected zones or archeological sites.

Peru has relied on cooperation alliances to build their technical capacities and to exchange experiences on sustainable building policy-making.

Some of the most relevant cooperation initiatives currently in place are: the project, Development and Implementation of a Sustainable Housing Code in Peru, InterCLIMA – the learning platform for the promotion of a low-carbon development, the program, Development of Construction Measures and their Relation to Climate Change, and the design of the National Roadmap to Achieve Low-Carbon, Sustainable Buildings for Climate Change Mitigation, among others. These initiatives prove that Peru seeks to integrate sustainable building into their national agenda and they are on the road to achieving it with support from international cooperation initiatives.

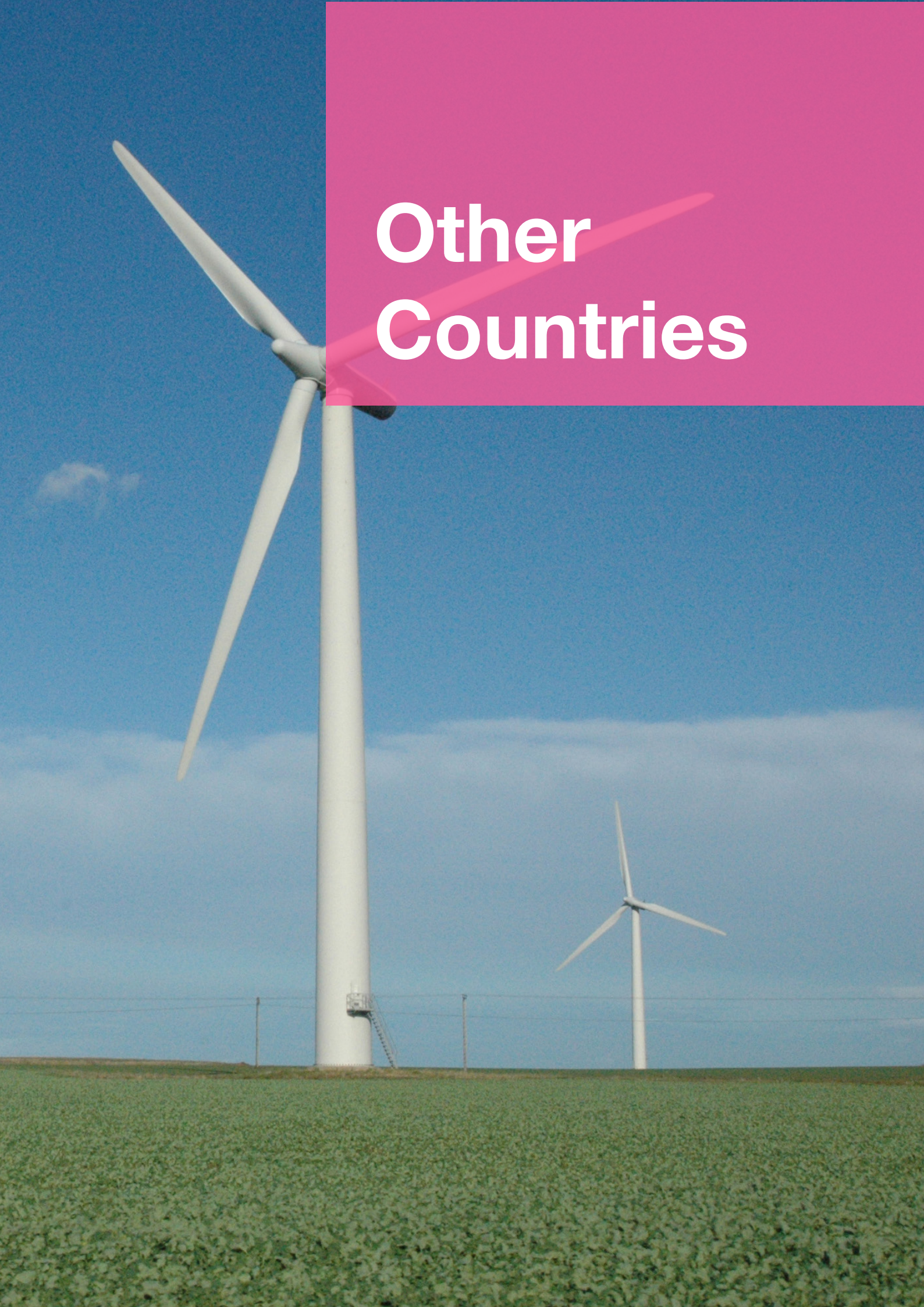
Finally, some of the most relevant future recommendations for the development of the national green building policy framework are: to achieve the execution of the Referential Plan for the Efficient Use of Energy, by the establishment of financial and capacity-building mechanisms; one of the most important national challenges is building institutional capacities for the development and implementation of green building and energy efficiency policies.

Furthermore, recommendations highlight the importance of achieving the goal of developing energy efficiency technical standards that set the minimum construction requirements of thermal conditioning, passive design, minimum energy efficiency levels and the use of eco-technologies.

Finally, it is also recommended to create a transversal sustainable building strategy and a cross-sectorial green building committee that facilitates the interaction between the different governmental institutions.



# Other Countries





## 7.1 Strategic Alliances in Central America

The Central American region has formed a series of strategic alliances related to topics such as climate change, energy efficiency, sustainable social housing initiatives, and general sustainable development actions. Countries such as Costa Rica, El Salvador, Guatemala, Panamá and Nicaragua are part of these alliances. Some of the initiatives that are directly and indirectly related to green building are:

- Alliance for the Sustainable Development of Central America

It is a regional strategy to support the coordination and consultation of interests, development initiatives, and rights harmonization. Established institutional organizations support the implementation of the alliance and seek to turn sustainable development into a central and strategic policy in the regional states (ADSC, 1994).

- Regional Program of Energy Efficiency

The program proposes two objectives, one of them consists in jump-starting energy efficiency markets, related to the final use of energy, mainly: lighting, motors, commercial refrigeration, and air conditioning systems. The other one is a global objective that seeks to reduce GHG emissions produced by thermal generation in the inter-connected national systems of Central America. The program bases its initiatives in four countries: El Salvador, Nicaragua, Costa Rica and Panamá, and shares its knowledge platform with Honduras, Guatemala and Belize (BUN-CA, 2014).

- Central American Strategy of Housing and Human Settlements

It's a strategic instrument approved by Heads of State and governments of the member countries of the Secretariat for Central American Social Integration, which seeks to reduce poverty and improve housing conditions of the Central American population (SISCA, 2014). The development of the project, Regional Guidelines for Sustainable Housing Planning, Design, Construction and Financing, was developed under the context of this strategy (CCVAH, 2013).

- Environmental Plan of the Central American Region 2010-2014

The plan focuses on environmental governance, based on a management model of environmental implementation and compliance that emphasizes cross-sectorial and inter-institutional initiatives. The plan consists of two action lines:

1) political action to achieve transversal environmental management and inter-institutional coordination, so institutions achieve the integration of environmental policies, by providing technical support.

2) Technical management of the Central American Environment and Development Commission, which provides support to national environmental authorities in topics such as environmental quality and natural capital management and climate change adaptation (CCAD, 2010).



# 7.2 Guatemala

## 7.2.1 Context

According to the Ministry of Energy and Mines, to 2010, the final consumption of electricity in Guatemala was distributed as follows: industrial, 33.5 %; residential 27.1 %; commerce and services, 22.2 %; domestic consumption 4.2 % and losses 13.0 % (MME, 2011). However, according to the National General Balance of Energy Consumption, the use of firewood for cooking constitutes the greatest source of energy consumption in the country, with 58 % of the total energy demand (82.3 % of homes still use firewood for cooking), followed by fossil fuel consumption: diesel in second place with 17 %, gasoline in third place with 13 %, and finally, electricity with 9 % *ibid*. The high consumption of firewood is because a great majority of the population lives in rural areas with a low-income, which impedes the access to other energy sources.

Future scenarios show an increase in the demand of the energy sector due to an increasingly growing population in urban areas. Guatemala has a population annual growth rate of 2.4 %, mainly constituted by indigenous people that belong to the Mayan, Garífuna, Xinka and Ladino groups. 60 years ago, the urban population in Guatemala represented 33 % of the total population, increasing up to 50 % on 2011, with projections that the urban population will be 17 % larger than the rural in 2020 (ABG, 2013).

The Development Plan, K'atun, Our Guatemala 2032 is in the beginning stages and it establishes a new vision of economic development engines for the years to come, considering the construction sector as a key national growth strategy. The plan estimates that 17 million people will be living in cities by 2032, and considering this, it establishes the following objectives: land and urbanization for social housing developments, recovery of traditional neighborhoods, systematic and planned growth, interconnected cities, friendly and compact cities, and green recreational areas, among others. Community participation has been a fundamental aspect for the elaboration of the Plan, therefore, territorial, sectorial, community and committee dialogues took place for its development *ibid*.

In 2012, the construction sector contributed only to 2.9 % of the GDP (Banco de Guatemala, 2012), and in that same year, had a growth rate of 0.7 % in respect to 2011. It was also estimated that up to 2012, Guatemala presented a qualitative housing deficit of 682,276 housing units and a quantitative deficit of 1,017,189 homes, with a projected deficit of 1,924,587 homes in 2015 (ABG, 2013).

In the past years, the economic and social impacts caused by climate change effects have made it indispensable to create a national climate change adaptation and mitigation policy. The National Climate Change Policy (NCCP) establishes the specific objective of reducing GHG emissions via the efficient use of energy and clean energy production through the development of specific plans for the industrial and residential sectors (PNCC, 2009). Furthermore, the NCCP disposes that infrastructure should be constructed according to quality norms and standards that consider vulnerability to climate change effects in the different regions of the country, considering the risks to which they are exposed.

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*Solar panels on one of the companies that offer energy Guatemala to Honduras Electric Company (Source: revistaei.cl)*

## 7.2.2 PMain energy efficiency and sustainable building initiatives

For some years, the State has been making progress in the development of the energy efficiency policy framework, by implementing diverse strategic actions for the incorporation of the topic in the national agenda. Some of the most relevant actions are the organization of a technical cooperation program with the Inter-American Development Bank (IDB), for the development of the Energy Efficiency Integral Plan in 2008 (CNEE, 2013). Another initiative is the development of a preliminary draft of the Energy Efficiency Law, which was presented to the congress in 2012 for approval.

The draft proposes the creation of the National Energy Efficiency Council; the Integral Plan of Energy Efficiency; financial mechanisms, regulations and other initiatives for the implementation of energy efficiency measures. Such initiatives include the development of energy efficiency technical standards, the certification, accreditation and labeling of energy consumption equipment, the development of efficient market technologies, public acquisitions regulations, development of an energy information system, creation of a national award as an incentive, promotion means and research (CNEE, 2013).

Furthermore, in 2009 the National Energy Efficiency Program was developed, which set a series of short and medium-term strategic goals. The following are some of the most relevant actions related to the sustainable building sector:

### Short-term:

- Efficient lights for municipal and residential public lighting.
- Energy efficiency program in public buildings: pilot projects in the Ministry of Energy and Mines and in the National Electric Energy Commission.
- Marketing campaign for energy saving in the residential sector.

### Medium-term:

- Commercial and industrial business program.
- Residential program.
- Implementation of a labeling system or adoption through international agreements.
- Review of existing incentives for renewable energies.
- Criteria and indicator proposal for efficient housing and buildings.
- Energy efficiency incentive harmonization.

As part of the initiatives of the National Energy Efficiency Program, in 2012 a cooperation agreement was established with Mexico, through their Energy Saving Trust Fund (FIDE for its acronym in Spanish), to carry out the Integral Training and Technical Assistance Program for Professional Development in Electric Energy Saving and Efficient Use. Some of the training topics related to sustainable building are: energy saving and efficiency in lighting, air conditioning and refrigeration systems (CNEE, 2013).

Furthermore, the Energy Policy 2013-2027 was recently created as an instrument that strengthens current policies of the energy sector and seeks to improve the inter-institutional coordination, contributing to transform the energy sector matrix towards one based on renewable sources. Its main objective is to contribute to the sustainable development of the energy sector in the country, with social equity and environmental respect (MME, 2013). It sets five main pillars that orient the Policy, the fourth one is Energy Saving and Efficient Use of Energy. This pillar seeks to create the mechanisms for the productive and efficient use of energy and to achieve that 30 % of public institutions contribute to the efficient use of energy *ibid*.

Another relevant action is led by Guatemala Green Building Council (GGBC) and the ANACOVI (National Association of Housing Builders – Guatemala Construction Chamber Union) that consists on the creation of a national certification tool to evaluate housing performance with evaluation criteria that is adapted to the local demands (the tool is still in the process of being approved) (GGBC, 2014). Moreover, the GGBC and the Municipality of the City of Guatemala developed an initiative that grants municipal incentives for public-private developers if they comply with the requirements established by the GGBC.

On the other hand, the National Housing and Human Settlements Policy establishes that the State must ensure the economic, social and environmental sustainable development of the housing and human settlement sector, in such a way that investments that are made in the present don't endanger future resources. Finally, regarding the private sector, it can be said that the green building industry is making slow progress, as of 2014, there are only 16 LEED registered projects and 8 that have been certified.



### 7.2.3 Case Study

In the context of the technical cooperation program supported by the IDB, for the development of the Energy Efficiency Integral Plan, in 2008, four main pillars were included, one of which is "Definition and Financial Schemes of the EEIP and Pilot Projects". In 2012, the results of 9 pilot projects in commercial and institutional buildings were presented, with the intent of demonstrating that the energy efficiency measures that were applied are technically feasible, economically profitable and that through their compliance, actual reductions of energy demand were achieved (CNEE, 2012).

Different solutions were applied for each one of the buildings. In some cases, efficient technology lamps substituted incandescent lamps, in other cases more efficient firewood stoves were installed, air conditioning systems were replaced or solar panels were installed.

The nine projects included among them, the Ministry of Mines and Energy and the General Direction of Energy, where traditional lamps were substituted with high-efficiency technology lamps. Furthermore, 28 photovoltaic panels of 245 W and an inverter for its connection to the electric grid were installed in the University of the Valley of Guatemala.

Results for the lighting substitution projects demonstrated that these measures were successful in the reduction of electric energy demand; however, one of the barriers presented was that there was no continuity in the initiatives of efficient technology replacement in the institutional premises

(CNEE, 2012). Regarding the results of the pilot project for the University of the Valley of Guatemala, results show substantial energy savings and they also have a verification system that allows the measurement of electricity generation from the project. However, one of the barriers for the future replication of the project is that photovoltaic panels are long-term investments and the return on investment can be of a period of up to seven years. Also, the project has not yet validated so it can obtain tariff benefits that incentivize the acquisition of technology *ibid*.

Finally, considering the results from the nine pilot projects, some recommendations are established for improved implementation: development of energy auditing mechanisms; the incorporation of a protocol that allows finding the factors that affect consumption and that determine their influence in the project's future results; development and implementation of protocols to determine real savings in energy efficiency projects; to involve companies' /public institutions' acquisitions area in order to incorporate the use of energy efficiency technology, among others.

## 7.2.4 Future Actions

The government is currently working on strategic actions for the development of the energy efficiency policy framework and national planning instruments. Some of the main initiatives currently in the process of development are: The preliminary draft of the Energy Efficiency Law, which is the base of the energy efficiency policy framework and that contemplates the development of energy efficiency technical standards and the incentives for their implementation. Also, one of the most important future initiatives is the National Plan, K'atun, Our Guatemala 2032, which contemplates the construction sector as a development engine and considers the development sustainable cities.

Considering the previous context, the government's initiatives and the construction sector's development process in other Latin American countries, the following future actions are recommended:

- To consider that the construction sector is beginning to take relevance as a productive sector in the country and visualize this fact as an opportunity area to establish sustainable parameters in the development of future cities.
- Explicitly incorporate a sustainable building strategy in the National Development Plan to 2032.
- Incorporate sustainable building solutions to the development of the national energy efficiency technical standards (thermal conditioning, bioclimatic design, etc.)
- To explicitly integrate the building sector as a means to achieve energy efficiency institutional goals (to achieve that 30 % of public institutions contribute to the efficient use of energy) in the Energy Efficiency Integral Policy and the Energy Policy 2013-2027.
- To incorporate energy efficiency programs for the residential and social housing sectors.



Guatemala will install more than 10,000 solar photovoltaic panels on 1,400 homes (Source: mimbrea.com)

## 7.2.5 Lessons Learned

Guatemala presents great opportunities for the incorporation of the sustainable building sector in the national policy agenda. The country shares a vision with other Central American to incorporate sustainability concepts for national and regional development. This is reflected in the National Development Plan 2032, still in development process, which shows in its published advances that the state has included transversal sustainability elements both in the process of elaboration, which is carried out in a community consensus manner, and in the transversal actions the plan considers for the country's development.

Facing a growing population and an increase in the urban population, the country contemplates the development of cities with sustainability precepts, such as orderly and planned growth, interconnected cities, friendly and compact city and green recreational areas, among others. However, it is important to highlight that compared to other Latin American countries, Guatemala shows less progress with the development of sustainable building and energy efficiency policies that incorporate the construction sector as support for the reduction in energy demand.

Efforts to build the energy efficiency institutional structure have been done recently, however, the sector is still in initial stages. International support has been crucial for financing and capacity building to achieve the previously mentioned progress. Some of the short-term actions proposed in the National Energy Efficiency Plan were executed through the initiative presented in the case study; nine pilot projects were developed in order to test the effectiveness of energy efficiency measures, such as efficient technology lamp replacement

and the incorporation of renewable energies in public buildings, among other measures, presenting positive results in energy demand reduction.

Also capacity-building initiatives were done in alliance with the FIDE, in order to form energy efficiency local professionals. Nevertheless, some of the medium-term actions of the Plan are still to be implemented, such as the development of energy efficiency technical standards and the incentives for their application, the criteria and indicator construction proposal for efficient housing and buildings, among others.

It is also evident that basic sustainable building practices to reduce energy demand, such as thermal conditioning and/or bioclimatic design are not integrated in the pilot projects nor in the plans for technical standard development. Some of the recommendations for future actions include the explicit incorporation of such measures into the energy efficiency technical standard planning.

Finally, the LEED Certification is currently one of the few available tools in the market for the development of buildings that integrate sustainability in a holistic perspective. However, the country's current context is a relevant factor to fully understand the development process of the sustainable building sector in Guatemala. It must be considered that about 50 % of the population still lives in rural areas, that electricity is less than 9 % of the total energy consumption, and that more than 80 % of the population still uses firewood to cook. The development of sustainable building regulations must consider these conditions and the policy framework must be adapted to consider its application in both the rural and urban zones.

# 7.3 Panama

## 7.3.1 Context

According to the Energy Balance published by the National Energy Secretariat, the final consumption of electric energy in the country is distributed as follows: Residential, 31 %; Commercial, 43 %; Industrial, 7 %; Government, 11 % and Others, 7 %. (SNE, 2012). The current energy matrix is characterized by a poor diversification in its supply and by its strong dependence on oil derivatives, producing 85.4 % of the energy from imported oil, 14.4 % from hydroelectric sources and 0.1 % from biofuels (sugar cane) (SNE, 2009).

An increase in energy consumption is estimated as a consequence of the economic growth of the country. In the last five years, Panama has shown an annual GDP growth rate of 8.9 %, becoming one of the most vigorous economies in Latin America (OBG, 2012).

In the last years, the government has oriented its administration towards the promotion and consolidation of a financial service center that incentivizes foreign investment and economic development by offering significant advantages to foreign multinational corporations that install their regional headquarters in Panama (OBG, 2012). As a consequence in the last years the construction sector has increased its contribution to the GDP. Up to 2011 the construction sector GDP grew 15 % in respect to 2010, representing approximately 7 % of the total national GDP (ICEX, 2012).

As a result of the national economic growth and the injection of foreign capital, the construction sector presents an important dynamism, where new market niches emerge, such as hotels, restaurants, office buildings, malls, housing and industrial sectors, among others (CPC, 2010). On the other hand the country presents an estimate housing deficit of 136,645 homes, with an annual growth rate of 15 %, according to data from Covivienda (ICEX, 2013).

Panama has been active in the development of policies to face climate change effects. The National Climate Change Mitigation Strategy, presented on the Second National Communication of 2012 prioritizes mitigation measures of sectors that have been identified as significant, due to their contribution to GHG and CO<sub>2</sub> emissions. The strategy seeks to establish incentives for the incorporation of mitigation measures, in a way that economic activities are compatible with a sustainable social development (SCN, 2012). The energy sector is considered a priority, as it is the main national contributor to the GHG and CO emission inventory. Solutions such as the use of efficient lighting, solar heaters and photovoltaic, thermal and wind energy have been proposed, among other strategies *ibid*.



Additionally, Panama has progressed in the implementation of CDM projects and according to the Second National Communication of 2012, environmentally friendly buildings and efficient lighting projects are included among the energy efficiency project portfolio.



*Ecological wood stoves, spend less wood than a traditional stove.  
(Source: [elsiglo.com](http://elsiglo.com))*

## 7.3.2 Main initiatives of energy efficiency and sustainable building

Panama has taken important steps in the development of the energy efficiency institutional structure, which recognizes the building sector as a key strategy for the reduction of energy demand. The Law 69 of October 2012 sets the general guidelines of national policy for the rational and efficient use of energy, which was enacted and put into force in October 2013 (SNE, 2013).

The regulation of the Law 60 of 2012 sets, among others, includes the following initiatives, linked to green building:

- The use of efficient illumination in public lighting.
- Labeling guidelines of energy consuming equipment.
- Establishment of minimum efficiency levels for refrigeration, air conditioning, pumps, motors and energy saving materials.
- Development of energy efficiency technical standards for buildings that promote the energy savings from the design state, including electric installations, air conditioning and refrigeration.
- Introduction of building passive design solutions to save energy, which allow the maximization of all energy sources.
- Organization of the UREE Program for the private sector.
- Development of professionals and energy service companies.
- Steering Committee of Energy Efficiency Indexes (SCEEI)
- Research, education and diffusion
- Norms, labeling and certifying laboratories
- Financing
- Incentives and subsidies

Also, the Strategic Plan for the Rational Use of Electric Energy (UREE), still under development and proposes the following strategic lines for the implementation of the regulation of the Law 69:

- Founding of the Energy Committee.

The SCEEI is the responsible organization for the regulation and implementation of minimum indexes of energy efficiency for equipment, materials, energy consumption machinery and buildings, and of establishing goal programs for each regulated sector, among other responsibilities (SNE a, 2012).

The UREE Plan also establishes that all of the materials, equipment, machinery and/or buildings uses for the reduction of energy consumption, must have a label that shows, at least, its energy consumption in normal operation conditions, the normal conditions for the calculation of energy consumption and its energy efficiency index in a period no longer than 12 months after the enactment of the Law 69 of 2012.

Furthermore, it is established that all buildings are obligated to comply with the UREE norms, established by the General Direction of Norms and Industrial Technology and also with the minimum energy indexes established by the SCEEI *ibid*.

The SCEEI's current work is the homologation, adoption and/or adaptation of the following norms:

- NOM-011-ENER-2006 – Energy Efficiency in Central Air Conditioning Systems – time limit: July 2012- June 2014.
- NOM-015- ENER-2002 – Energy Efficiency of Refrigerators and Domestic Freezers – time limit: Jan – Jun 2014.
- NOM-017-ENER/SCFI-2008 – Thermal Insulation for Buildings – time limit: Jan-Jun 2014
- NOM-018-ENER-1997 – Energy Efficiency in Room Air Conditioning Systems - time limit: Jan-Jun 2014
- NOM–016-ENER-2002 – Energy Efficiency of AC motors- time limit Jul 2013 – Jun 2014.

In 2014 began the development of the program UREE Mortgage, which proposes granting a 5 % discount over the amount of interests paid to low-income houses that incorporate energy efficiency measures in its construction (SNE a, 2012).

In 2014 began the development of the program UREE Mortgage, which proposes granting a 5 % discount over the amount of interest paid to low-income houses that incorporate energy efficiency measures in its construction (SNE (a), 2012). The purpose is to create a financing mechanism with reduced interest rates for buildings that consider energy efficiency from its design and that are certified under criteria (still to be defined by the National Energy Secretariat), in conformity with the current legislation (SNE, 2013). The plan is that in 2014 the Incentive and Subsidy Plan and the structure of the program are fully developed *ibid*.

With the objective of developing incentives for building certification, and in order to apply them to programs such as the UREE Mortgage, currently the draft of the Norm for New and Existing Buildings is being reviewed, which includes and goes through the following: electric circuits, lighting systems, water heating, intelligent systems, thermal insulation, air conditioning and thermal load calculation (SNE, 2013).

The objective is also to incorporate minimum energy efficiency indexes, with the objective of developing measuring patterns to grant the subsidies.

Furthermore, the "Intelligent Network in Market Environment" is established for the implementation of energy efficiency measures for the generation, transmission, distribution and demand stages (SNE a, 2012). For the demand stage, a series of areas of implementation are developed, including the setting up of a demand control for buildings and homes with intelligent systems, in order to reduce demand peaks and thermal losses of the system *ibid*.

The application of sustainable building practices in the private sector has increased over the last years. In 2014 there are a total of 52 registered projects to obtain the LEED Certification, of which 10 have already been certified (USGB, 2014).

Projects that have obtained the LEED certification are: The United States Embassy in Panama, new headquarters of the Panamanian Association of Business Executives, Visitor Center of the Panama Rain Forest Discovery Center and the Dormitory of the Knowledge city with the first LEED Platinum certification in the Central American Region, among others. These projects set new construction parameters for future real estate developments, especially for those of foreign investment.

### 7.3.3 Future Actions

Panama is in the process of creating the policy framework that includes technical standards, programs and incentives to promote energy efficiency measures, which incorporate the construction sector as a strategy line to achieve the reduction of energy demand. Some of the projects that constitute the most relevant future actions are: the development of the National Energy Efficiency Policy; the revision and enactment of the Norm for New and Existing Buildings, which includes energy efficiency measures with the objective of establishing parameters to grant incentives; the development of the Incentive and Subsidy Plan and the functioning structure of the UREE Mortgage program; the adoption and homologation of energy efficiency norms and the development of energy efficiency building labeling, among others *ibid*.

Considering Panama's context and what was previously presented, the following recommendations for future actions are considered:

- Development of a sustainable building strategy, with support from cooperation alliances.
- Strengthening of institutional technical capacities for the development of sustainable building policies.
- Incorporation of sustainable building practices in the national agenda in a more holistic way, considering voluntary certifications, such as AQUA, BREEAM and LEED, among others, as examples for the development of a local green building code or technical standard.
- Development of social housing programs that incorporate sustainability parameters.



Proyecto de Renovación Urbana: Curundú, en Panamá  
(Fuente: [miviot.gob.pa](http://miviot.gob.pa))



## 7.3.4 Lessons Learned

Panama is now going through the development process of their energy efficiency institutional structure, which incorporates the construction sector as one of the main strategy lines for the reduction of energy demand. The Law 69 of 2012 sets the general guidelines for the efficient use of energy and establishes the development of the UREE Strategic Plan, which stipulates, among other actions, the development of building energy efficiency technical standards and the creation of subsidies and financial mechanisms for their application, such as the UREE Mortgage Program (still in development process), which focuses on financing energy efficiency measures for low-income houses.

The UREE Program also includes the development of an energy efficiency labeling program for buildings and reviews the Technical Standard for New and Existing Buildings, with the aim of integrating minimum energy efficiency indexes in aspects such as lighting systems, water heating, thermal insulation, air conditioning and thermal load calculus.

In the last years, the real estate market in Panama has significantly grown due to the incentives granted to multinational companies that establish their regional headquarters in the country. Considering this, the development of an Energy Efficiency National Policy that integrates the building sector, considering both the private and the social housing sectors, is of great relevance and makes sense.

However, this progress should only be the first step towards the development of a broader policy framework where sustainable building becomes a transversal topic in the public

agenda and more holistic sustainable building practices are implemented besides energy efficiency measures.

On the other hand, the real estate market in Panama is at an ideal moment to harness the growth of the voluntary certification market, which could establish higher and more sustainable building standards. It should be highlighted that the modifications to the Technical Standard for New and Existing Buildings do not contemplate aspects such as the efficient management of water, air quality, connectivity, site selection or other sustainability principles. Considering this, one of the recommendations is the development of a sustainable building technical standard and/or code, which is adapted to the local context and that considers broader sustainability aspects and can be applied by the growing real estate market. Panama is a clear example of an emerging economy, with the right conditions for the development and implementation of a sustainable building policy.

# 7.4 Costa Rica

## 7.4.1 Context

In 2010 electricity represented 22.8 % of the total energy consumption and its demand is distributed as follows: industry, 25.2 %; residential 10.5 %; public, 2.9 % and commercial 2.6 % (MAET, 2011). Electricity consumption has increased 4.2 times in the last decade, with an estimated annual growth rate of 5.3 %, as consequence of an increasing trend of electrification in the county and residential and industrial use. Regarding electricity generation, the country's supply is fundamentally supported by three local renewable sources: hydroelectric source, which produces 76 % of energy, geothermic produces 12 % and thermic 7 %, summing up to the production of 95 % of electricity from renewable sources. However, Costa Rica still depends greatly on the use of fossil fuels for the rest of the energy sectors *ibid*.

In the year 2013 the construction sector had a general decrease of 4 % in the building GDP, however the housing sector, which represents more than 40 % of the total building sector in the country, sustained a growth rate of 7 % (Bermudez, 2014). It is expected that in 2014 the building sector will benefit from modifications to conditions that limited the sector's growth, such as credit restrictions. Due to this changes, the Costa Rica Construction Chamber projects a growth between 7 % and 10 % by the end of 2014 *ibid*. Finally, the housing deficit was reduced from 14.4 % in 2011 to 13.8 % in 2012, due in part due to a reduction in the number of irregular or overcrowded housing conditions (FUPROVI, 2013).

Costa Rica presents their ambitious national aspirations in the National Development Plan of 2010-2015. Their goal is to be among the first developed nations in Latin America, a world leader in the use renewable energy, and to achieve the status of a "carbon-neutral" nation by 2021 (PND, 2010). Costa Rica doesn't aspire to any type of economic growth, but to one that is inclusive with the values of respect to nature and life *ibid*. To achieve this, four transversal lines of action are established, one of them is Environment and Land Use Planning, from which four main pillars derive: Land Use Planning, Water Resource and Waste Management, Carbon-Neutrality and Climate Change, and Biodiversity and Renewable Energies.

Climate change is integrated at the highest political priority agenda and this is reflected by the inclusion of the subject in planning instruments such as the National Development Plan, the presidential initiative, Pact with Nature, and in an agreement of the Government Council which establishes the state's action framework to face climate change and it is also articulated in the Climate Change National Strategy (CCNS) (MAET, 2009).

The CCNS also includes the goal of achieving a carbon-neutral economy that strengthens the economy's competitiveness and sustainable development. In order to achieve this, the CNNS considers eight key sectors for GHG mitigation, the following are related to the building sector: energy, industrial and tourism *ibid*.

In the energy sector, two fundamental areas are considered to achieve the objective: clean energy generation and energy efficiency (MAET, 2009). For the industrial sector, mitigation actions oriented to energy efficiency in industrial processes and construction is considered the most effective way to share mitigation efforts in this sector. However, most of the implemented initiatives in the country have been undertaken by the private sector.

Regarding adaptation to climate change, the CCNS recognizes that in 2006 the building sector had the with highest growth rates of all sectors (increase of 18 %), representing 4 % of the national GDP, and had a projected expansion, based on a list of national tourism and urban projects planned for the next years (MAET, 2009). Considering this, the following adaptation to climate change measures are considered for the infrastructure sector: to apply the concept of energy efficiency in the design and construction of buildings; to increase the levels of building comfort (thermal, noise, air quality); maximize energy saving measures; to optimize plan distribution and allow spaces for additional use, and to promote the use of clean technology in existing buildings through the use of environmentally friendly materials *ibid*.

## 7.4.2 Main energy efficiency and sustainable building initiatives

Having the challenge of achieving ambitious national goals, the government of Costa Rica has made considerable progress in terms of energy efficiency and green building. The Law No 7447 of 1994 of Rational Use of Energy Regulation establishes the mechanisms to achieve the efficient use of energy, considering environmental protection. Mechanisms are based on three postulates:

- 1) The obligation to implement projects for the rational use of energy in high-consuming companies;
- 2) Control over equipment and installation that in their general use have a high energy demand and
- 3) the establishment of a labeling system that informs users about energy consumption levels (Ley 7447, 1994).

Furthermore, the Decree No. 25584-96 that regulates the Law No. 7447, establishes incentive and co-financing schemes for companies that achieve energy-savings, and it sets the minimum levels of energy efficiency that equipment must meet.

In 2007 the Energy Efficiency Committee was formed and energy efficiency technical standards were developed. The standards focus on: lighting, refrigeration (domestic and commercial), motors and air conditioning. Also, certification systems were developed to label equipment that complies with the requirements established in the standards (INTECO, 2010).

Regarding sustainable building, in 2012 the technical norm, RESET (Requirements for Sustainable Buildings in the Tropic) was published. The norm was created by the Tropical Architecture Institute and was donated to the Association of Architects and to INTECO (Technical Norm Institute of Costa Rica) for its establishment as a national standard (INTECO, 2012). The norm contemplates requirements for the design, construction and operation stages and it's based on the premise of "sustainability with more architecture than technology", meaning that it maximizes the design potential before turning to the use of technology *ibid*.

The norm is applicable to individual and collective buildings and other infrastructure and has the objective of establishing the requirements that buildings must meet in order to be considered sustainable. The compliance of the RESET norm is evaluated through the completion of criteria in different categories that determine the level of achievement. The RESET certification, which is represented by a sun, requires the completion of all of the required criteria in each category. The RESET Plus certification can be achieved by complying with all the requirements, and additionally pursuing the "plus" points in each category to get one or two additional suns. The following are the categories that are evaluated (INTECO, 2012):

- Preliminary studies – 3 objectives and 28 criteria.
- Socio economic aspect - 4 objectives and 11 criteria.
- Environment and transport - 3 objectives and 25 criteria



- Calidad y bienestar espacial - 3 objetivos y 26 criterios.
- Spatial quality and wellbeing - 3 objectives and 26 criteria.
- Land and landscape - 4 objectives and 19 criteria.
- Materials - 2 objectives and 15 criteria
- Optimización de la energía - 2 objetivos y 9 criterios.
- Water use optimization - 2 objectives and 9 criteria

The following reference norms are indispensable for the implementation of the RESET norm:

- INTE/ISO 15392 – Sustainability in the construction of buildings – general principles.
- INTE/ISO 21929 – Sustainability in the construction of buildings – Sustainability indicators part 1: Reference framework for the development of building indicators.
- INTE/ISO 21930 – Sustainability in the construction of buildings – Environmental declaration of construction products.
- ISO/TR 21932 – Buildings and built assets - Sustainability in the construction of buildings – Terminology.
- INTE 31-08-06 – Lighting conditions and levels for working centers.
- IEC 61000-3-2. IEC 61000-3-2 – Limits for Harmonic Current Emissions.

The RESET norm is now a voluntary national standard adapted to the local context and considered a lower-cost option than other international certifications due to its focus on

architectural solutions rather than on the use of technology. This is because it's considered that in some cases, high costs of voluntary certification is one of the main barriers when contemplating sustainable building projects.

Similarly, in 2011 the Banco Popular and the International Union for Conservation of Nature, launched an innovative award named First Contest for Sustainable Middle-Class Housing in Costa Rica, with the objective of incentivizing the development of sustainable housing alternatives for workers, which provide a positive environmental and social impact (INAISE, 2011).

This initiative sets a precedent in the country and in Central America due to the promotion of culture transformation in the construction sector, seeking innovative proposals of comfortable and sustainable vertical designs. Another important aspect is that from the competition and the regulations established in them, the Banco Popular developed credit products specifically directed to these type of constructions *ibid*.

For Costa Rica, tourism is one of the most important economic engines, representing 30 % of the country's economic services, therefore it is established that: sustainable tourism is not only an answer for the demand, but an indispensable condition to successfully compete now and in the future (ICT, 2014).

There are a series of programs in the country that incentivize sustainable building practices in the tourism sector. One of them is the Sustainable Tourism Certification (STC), which is a program promoted by the Costa Rica Tourism Institute, designed to categorize and differentiate tourist companies according to the level in which their operations comply with a sustainable model (ICT, 2014). The STC evaluates four fundamental aspects: biological physical environment, service management, external clients and socio economic environment.

The guideline to obtain the STC considers aspects such as: energy efficiency, water optimization and implementation of wastewater systems, sustainable products, use of eco-technologies and waste disposal *ibid*.

A series of planning systems, focused on energy savings, were set in motion through the Energy Efficiency Regional Program for Small Hotels (PEEST), financed by the Hivos foundation, and developed by the Red Energy Foundation (BUN-CA).

Through this initiative, from 2005 to 2011, technical assistance was provided to small and medium hotels to carry out an energy audit, followed by an investment in diverse actions to improve their energy efficiency, such as: installation of small renewable energy systems, technical capacity-building, monitoring of energy savings, and access to sustainable certifications for the tourist sector (Blanco et al., 2011).

These measures have resulted in savings of at least 1 million KWh of electricity per year in a group of 71 hotels in El Salvador, Costa Rica and Nicaragua. Savings were possible due to the implementation of actions such as:

- The Technical Norm Institute of Costa Rica developed an energy efficiency certification scheme for small and medium hotel companies.
- Promotion of innovative financing schemes. The Manual for Financing Energy Efficiency Projects in Central America, developed by BUN-CA, presented different financing schemes for the replacement of inefficient equipment.
- Experience exchange between hotels in the region.

- Development and diffusion of informative material that includes success cases.
- A collection of four technical manuals and best practice documents of electric motor technologies, air conditioning systems, lighting and commercial refrigeration.

Finally, the LEED Certification is another voluntary instrument available in the country. To date, there are 50 projects registered, from which 18 have been granted with a level of certification.

### 7.4.3 Case Studies

In 2013 was the inauguration of the first sustainable social housing project, called Sustainable Community Los Olivos in the region of Guácima of Alajuela. The project was carried out by Holcim in alliance with other solidary associations. 64 homes were built with a vertical design, constructing 14 buildings of 2 and 3 floors and designed with bioclimatic principles to optimize the land's conditions in favor of the housing developments. 60 % of the site was left as a green space; recycled and renewable materials were used for the construction stage; energy efficiency solutions and the optimization of natural light were incorporated; energy saving and water reuse systems were installed; local biodiversity was addressed and educational and awareness raising workshops for families were carried out (EKA, 2013).

A socio economic study was carried out in order to identify the most vulnerable families and four lines of action were implemented to improve their quality of life: family economy, education, health and housing. A donation fund was established to finance the project and the users received subsidies for the construction of their homes. The project included private companies and professional individuals from the construction sector, who designed the sustainable community, Los Olivos (SUMMA, 2013).

## 7.4.4 Future Actions

According to the context and the energy efficiency and sustainable initiatives presented, the following future recommendations are considered:

- Development of incentives for the implementation of the RESET technical norm in different construction sectors such as public, residential and social housing sectors.
- Mandatory implementation of the RESET technical norm in public buildings via the modification of public acquisitions policy.
- To integrate building aspects such as insulation, bioclimatic design, thermal comfort, etc. in energy efficiency technical norms.
- Development of a transversal green building strategy that supports the goal of achieving carbon neutrality to 2021.
- Incorporation of sustainable social housing projects in international schemes such as CDM and NAMA.



## 7.4.5 Lessons Learned

Costa Rica stands out from other Central American countries as one of the most advanced in terms of sustainable development. The vision for their national development integrates sustainability in a transversal manner and the government sets the ambitious objective of becoming a carbon-neutral nation to 2021. Costa Rica is one of the first Latin American countries to implement an energy efficiency law (1994) and they stand out for the generation of clean energy, producing 95 % of the energy supply through renewable sources.

There is a sustainable technical standard available, which is adapted to the local context and that is voluntarily implemented. To obtain the certification the standard follows a model of point based on the compliance of criteria. It is based in the concept of sustainability with more architecture than technology, so it focuses more on architectural solutions for the achievement of sustainability in buildings.

The available energy efficiency norms consider aspects such as efficient lighting, refrigeration, motors, air conditioning and others. They do not include building energy efficiency measures that focus on aspects such as thermal comfort, insulation or passive design, thus future recommendations suggest the incorporation of such subjects so there can be an homogenization in the energy efficiency and sustainable building norms.

Costa Rica has shown its leadership in the sustainable building sector by hosting the First Contest for Sustainable Middle-Class Housing in Costa Rica. The program is led by the Popular Bank and the International Union for Conservation of Nature, and seeks to promote the development of guidelines and incentives for sustainable middle-class buildings. The country also shows its leadership by progressing in the sustainable social housing sector; the Sustainable Community Los Olivos

is the first sustainable social housing project in the country, and even though it was developed by the private sector, it's an important national model.

The Sustainable Community Los Olivos is the first sustainable social housing project in the country, and even though it developed by the private sector, its an important national model.

The sustainable tourism sector is approached as an area of opportunity for economic development. To do so, there are programs that incentivize elements of sustainable building in the tourism sector. One of them is the Sustainable Tourism Certification, which contemplates aspects such as energy efficiency, implementation of wastewater systems, sustainable materials, among others. Furthermore the Energy Efficiency Regional Program focuses on the implementation of efficient technology and echo-technology in small and medium hotels.

Among the most relevant future recommendations, the development of institutional incentives and programs that promote the implementation of the RESET norm for new and existing buildings is suggested. Also, the obligatory implementation of the norm in public buildings will support the government in the establishment of a leadership, by leading by example and will set a precedent for future constructions. Finally, the development of a transversal sustainable building strategy is recommended to guide the sector's efforts towards achieving the goal of being carbon neutral for 2021.

# Sustainable Social Housing in Latin America



The Latin American and the Caribbean regions present serious housing deficit issues, estimating that approximately 45 % corresponds to a quantitative deficit and the rest refers to a qualitative deficit, where households present low construction standards and require improvements in their existing structures (Winchester, 2005). It's estimated that the regional housing deficit has increased from 38 million homes in 1998 to a number between 42 and 51 million in 2011 (ONU-Habitat, 2012; Mac Donald et. al., 1998 cited in Winchester, 2005). Moreover, according to the previously presented contexts of each country, current trends show an estimated general increase in the housing demand for the coming years.

*How many families do not have a home or live in poor quality homes? Source: (IDB, 2012).*



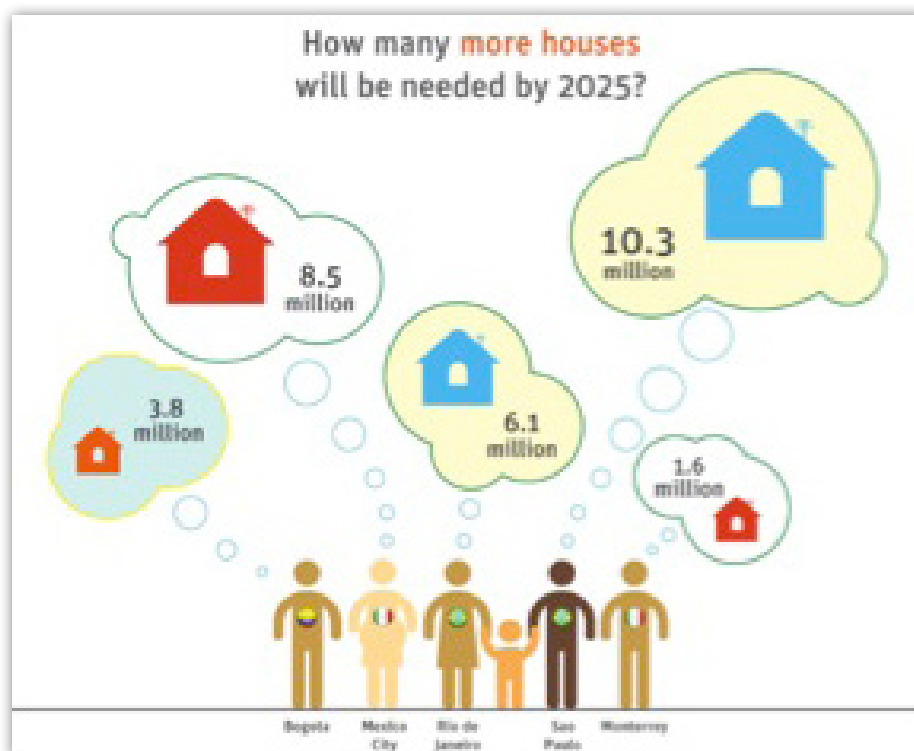
The rapid economic growth of Latin American countries has brought as a consequence unplanned urban growth, where new human settlements are formally or informally established in peripheral zones, where access to basic services such as water, light, transport and sanitary services are limited. Currently, Latin American governments are undertaking great efforts to regulate informal settlements or to relocate their inhabitants, in some cases, incorporating new land planning measures (DPA, 2011). In this context, the social housing sector is becoming increasingly relevant because it seeks to provide quality living conditions to the poorest sectors of society.

According to the Inter-American Development Bank, countries should improve land regulation mechanisms, incentivize financing, and activate public investment in order to increase the housing supply (IDB, 2012). Latin America stands out in the international context for the quality and diversity of the existing housing subsidy programs, which have been used as important policy instruments to meet the current housing demand (ONU- Habitat, 2012). However, it's important to highlight the State's fundamental role in the development of subsidy programs, given that in some cases, major housing development projects don't consider quality standards that promote durability, low maintenance costs, sustainability, and interior quality, among other parameters.

*Cover: Houses of social interest INFONAVIT in Cancun, Quintana Roo. (Source: vocero.qroo.gob.mx)*



How many more homes will be needed by 2025? Source: (IDB a, 2012).



Some of the issues that the region currently faces are the social and environmental impacts caused by the demand and construction of housing developments. Through the design, construction and operation, the sector is a direct consumer of resources, materials, water and energy (Banco Mundial, 2011). In consequence, the GHG and CO<sub>2</sub> emissions emitted by the sector are very significant, with a direct impact on social development. Three basic aspects define the housing sector's situation: 1) the quantity of existing houses (housing stock); 2) the quantity that is required (housing deficit) and 3) how many of them comply with minimum habitability standards that allow an acceptable quality of life (ONU Habitat, 2012). It is considered that such parameters are limited because they don't consider more subjective criteria such as habitability, thermal comfort, adaptation to the climate context, access to transport, quality of life, social equity, efficient use of materials, and sustainability, among others *ibid*.

Even though the definition of Green Growth is in continuous debate and development, for some years, it's a concept that has permeated the social housing public policy arena. In general terms, the development of policy frameworks that promote green growth consider the following structure:

- 1) provision of technical and financial support, establishment of clear objectives and monitoring systems;
- 2) establishment of prices and standards, such as taxes to carbon emissions or other mechanisms;
- 3) revision of the impacts that national public policy cause on local incentives, and 4) to promote the development of infrastructure that is aligned with sustainable development principles (OECD, 2013). The "greener" the public policy framework is, the easier it will be to address the specific challenges at the local level, and a more transversal coherence can be ensured *ibid*.



The international support for the development of new institutional structures that consider green growth elements has been fundamental in the region. An example of this is the Sustainable Social Housing Initiative (SUSHI), developed by UNEP to promote the implementation of sustainable building solutions in social housing programs in developing countries (UNEP, 2014). The initiative provides guidelines and case studies to policy-makers in order to integrate sustainable solutions for the design, construction and operation stages of housing units *ibid*.

In this context, and in accordance to what was presented in the previous chapters, it can be said that in the last years, the Latin American region has made significant progress in the development of public policies that promote sustainable building practices in the social housing sector. Specifically, some Latin American governments have created a synergy between the creation of policies and the implementation and monitoring of them, with the aim to develop, implement, refine, and adapt sustainable building and energy efficiency programs, initiatives and pilot projects. Some countries have established cross-sectorial strategies, planning instruments, technical standards and incentives oriented to the implementation of sustainable building solutions in the housing sector.

These initiatives have been implemented through pilot projects and programs, with the objective of testing their effectiveness and strengthening the national public policy framework. This chapter focuses on highlighting some of the most relevant sustainable building and energy efficiency initiatives that have been implemented in the social housing sector in nine Latin American countries.

# Sustainable Social Housing in Argentina

## Context

It is estimated that in 2009 the housing deficit increased to 2,487,583 homes and that more than 3 million houses present a qualitative deficit (Lazzari, 2009). According to the Argentinean Construction Chamber, this issue must not be approached only with a qualitative and quantitative perspective, where requirements for new houses and improvement of existing ones are met; but also, it must be addressed as a social and urban integration issue, where the construction of social housing is a determinant factor for the way in which society is constructed.

In the year 2000, the Ministry of Infrastructure and Housing, the Secretariat of Public Works and the Sub Secretariat of Urban Development and Housing of Buenos Aires published the Minimum Quality Standards for Social Housing. These standards establish the following parameters (Evans, 2012):

- Establishment of minimum indoor comfort requirements for warm and cold zones.
- Avoid condensation of walls and ceilings, in normal humid conditions and in temperatures that are relative to the zone.
- To ensure minimal lighting, ventilation, and sunlight conditions.
- To prevent moisture from entering the house through walls, ceilings and other openings.
- Acceptable acoustic privacy between houses and common spaces for domestic and ambient noise levels.

Dichos requerimientos de habitabilidad exigen el cumplimiento de las siguientes normas de acondicionamiento térmico:

- IRAM 11.601 (1996) – Thermal characteristics and thermal transmission calculus.
- IRAM 11.603 (1996) – Bioenvironmental zoning of the Republic of Argentina.
- IRAM 11.605 (1996) – Maximum permissible thermal transmittance.
- IRAM 11.625 (2000) – Condensation risk control.

According to a study by the Habitat and Energy Research Center of the University of Buenos Aires, which synthesizes standards, codes and policies related to sustainable building, it's considered that the Minimum Quality Standards for Social Housing don't ensure habitability conditions that can be considered as sustainable building practices (Evans, 2012). However, it is considered that there are a number of available instruments to improve energy efficiency and to promote thermal and lighting comfort in the social housing sector; the adequate implementation of the existing energy efficiency IRAM standards, related to building thermal conditioning, the use of thermal insulation and the application of the Renewable Energy Law are measures that social housing developers can reach to in order to accomplish an improved environmental performance.

Furthermore, the sustainable building technical standard, IRAM-ISO-15392 is currently in development process. This will be useful tool to implement broader sustainable building practices in the sector.

The province of Buenos Aires has taken actions to improve social housing conditions, with an orientation towards sustainability.

Measures to develop sustainability standards and integrate them into the Housing Policy have taken place.

Such measures seek to incentivize the efficient use of energy and to reduce pressures on the environment, with the objective of improving the quality of life and health of citizens (SSTUV, 2014). To exemplify this, the government of the province of Buenos Aires implemented the Thermal Conditioning Law (13.059/03) and its regulating Decree No. 1030/2010, which establish the required thermal conditioning measures for every construction of human use in the public and/or private sector, in the province of Buenos Aires.

With the objective of adequately implementing the Thermal Conditioning Law and the Energy Efficiency Law, the Ministry of Infrastructure developed a pilot project called "Design, Construction and Labeling of Energy Consumption", which sets in motion the first bioclimatic social houses in the province (SSTUV, 2014).

The aim is for them to be the first social houses in the country with an energy certification and that the implemented measures are above the required parameters by the IRAM thermal conditioning norms *ibid*. The pilot project consists of the construction of four houses in the municipality of Tlapalqué where the following bioclimatic schemes are implemented: cross ventilation, thermal insulation, direct solar radiation capture, natural lighting, flat solar collector, photovoltaic system, wall heating system, solar radiation control, and hot air generation (Instituto de la Vivienda, 2013).



*Social housing project in Argentina  
(Source: todosayudan.com)*

## Lessons Learned

As it was established in the Case Study section of Argentina, the government is currently working on the implementation of energy efficiency, thermal conditioning, and renewable energies technical standards in social housing projects. Three case studies were presented to show these initiatives. The project, Energy Efficiency and Renewable Energy in the Design, Construction and Operation of Social Houses follows a series of steps for the future replication of sustainable social housing projects. Such steps consist in the construction of houses according to current norms and laws (energy efficiency, thermal conditioning and renewable energies law), followed by monitoring and evaluation of the results, and finally the development and refinement of the national reference normative framework.

This "bottom-up" feedback process allows the establishment of national regulatory frameworks that facilitate the achievement of GHG emission reduction goals and allows the integration of sustainable social housing projects into international schemes such as NAMA .

On the other hand, the sustainable social housing project, 10 Houses for More Energy and the First Energy Efficient Neighborhood in Argentina is one of the most relevant projects in the country. It has the ambitious objective of developing the first energy efficient neighborhood in the country. The project has presented favorable results going from 10 initial houses to 33 dwellings that show significant energy savings, which has improved the quality of life of its users. Finally, the project 70 Sustainable Houses for Villa Manuelita is a project that seeks to incorporate broader sustainability practices such as construction material selection, energy efficiency during the operation stage and user's involvement in the whole construction and operation process. Furthermore, all of the mentioned projects have involved the participation of NGOs, research organizations, the private sector, and in some cases, international cooperation.

Finally, considering that in Argentina each province establishes their own construction code and that in most cases, provinces use as a reference the construction code of Buenos Aires, the previously mentioned initiatives establish an important precedent that can be replicated in the rest of the country. Furthermore, this process is fundamental for the future development of a national sustainable housing strategy that guides the national public policy towards a new construction paradigm.



# Sustainable Social Housing in Brazil

## Context

The country presents a housing deficit of 5.8 million units and it is estimated that from 2010 to 2022 the construction of 23.5 million new houses will be required (Caixa, 2011; CBIC, 2012). In recent years, the government changed the orientation of the National Housing Policy, giving priority to the assistance of the low-income population; subsidies for the acquisition of new houses were granted, incentives were provided to the middle class sectors and the private industry for the construction of new housing developments by expanding credits in order to broaden financing sources, and the creation of a stable market (Bonduki, 2012).

Thanks to this new policy, an institutional structure was created to establish mechanisms for housing access. The operation is directed by CAIXA Economica Federal (a state bank), which is the responsible institution for approving public and private housing projects, for financing the projects, and for assigning subsidies (Bonduki, 2012). The Housing and/or Urban Development Municipal Ministries are responsible for the development of local housing plans that regularize informal settlements, and of the production of new housing developments with or without association with the private sector for their construction.

Additionally, social participation such as community councils and social movements are involved in the process. The purpose of the National Housing Policy is to formulate

strategies to face medium and long-term housing needs in Brazil, with social inclusion and economic development *ibid*.

The federal program for housing development, Minha Casa, Minha Vida, is part of the Growth Acceleration Plans and was created by the government with an integral reach. It has the purpose of both contributing to economic growth through the construction sector, jobs, and promoting the access to decent housing (ONU-Habitat, 2013).

To solve the housing deficit problem, the federal government promoted the program in order to subsidize the construction of nearly 3 million low-income houses by 2014. In the first phase of the program (2009-2010), one million houses were built and subsidies were included for the voluntary installation of solar heating systems, with the objective of reducing carbon emissions. For the second stage (2011-2014), where 2 million houses will be built, it is mandatory for all units to incorporate solar heating systems (TWBG, 2011).

Furthermore, the Minha Casa, Minha Vida program allows municipalities to integrate additional requirements to the housing developments.

For example, the municipality of Rio de Janeiro published voluntary guidelines for sustainable design and construction that include recommendations in the following categories: rainwater use, use of non-toxic

materials, materials with reduced energy use, materials with recycled content, efficient use of construction materials to reduce the amount of waste, recycling facilities for users, natural site preservation, passive architecture design, and use of local materials, among others (TWBG 2011).

Brazil is the first Latin American country to implement SUSHI. From 2009 to 2011 the project was carried out simultaneously in two countries: Brazil and Thailand. During this period, the team approached the project from a local perspective to improve sustainability conditions in low-income homes, considering local priorities, challenges, and previous experiences.

The objective was not only to improve the environmental performance of the housing units, but also create momentum for a broader commitment to the implementation of sustainable measures in the social housing sector. In alliance with local actors, the team was dedicated to create awareness of the potential benefits of sustainable solutions, they mapped the available technologies and solutions, and provided specific recommendations adapted to the local context, to policy-makers (UNEP, 2009).



*Housing program Minha Casa, Minha Vida in Irecê. (Source: tvsaj.com)*

## Lessons Learned

As previously mentioned, Brazil has made significant progress in the development of voluntary sustainable building certification standards adapted to the local context, specifically for the social housing sector. The following are voluntary certification tools that can be applied to the social housing sector.

- **Selo Casa Azul da CAIXA**

CAIXA defines this certification as the first system to classify sustainable building projects in Brazil, developed for the context of the social housing sector. It has the following objectives: to promote the rational use of natural resources in the social housing sector; reduce the development's monthly costs and the monthly expenses of users, and to create awareness among developers and users about the benefits of sustainable housing developments (Shoji et al., 2013). Constructions must comply with six categories: urban quality, thermal comfort, energy efficiency, materials and resources, efficiency in the use of water, and social practices *ibid.*

- **AQUA Process**

It's a construction process that procures high environmental quality and consists in carrying out project supervision in all of its stages (program, design, construction and operation). It is based in the French methodology, HQE (High Environmental Quality), AQUA and it adapts the certification system to the Brazilian context. In 2010 the first version of AQUA was launched, implementing it to a social housing prototype located in Sao Paulo (TWBG, 2011).

Regarding examples of the implementation of voluntary certifications, a success case for the Selo Azul da CAIXA certification, is the Paraisópolis neighborhood, a complex of 171

housing units where considerations such as urban quality, thermal comfort and energy efficiency, the use of low environmental impact materials, water efficiency systems and social practices were the base for the development of the project. The project achieved an effective use of natural resources, the environmental comfort of residents, access to public transport and basic services, and positive social practices among the community. The project was awarded with the second place of the Holcim Awards in 2012 and was certified with the gold category due to the completion of 39 of the 46 criteria of the Selo Azul CAIXA certification methodology (CAIXA, 2014).

Other examples were developed through the program Morar Carioca, also known as the Municipal Plan for the Integration of Informal Settlements, which has the objective of regularizing 232,000 homes by 2020, through integral development, provision of basic services, sustainable urban planning, improvement of construction, and regularization of the land property. In the case of two favelas, Babylonia and Chapéu Mangueria the gold certification of the Selo Azul da CAIXA certification was obtained (Shohi, 2013).

The area was re-urbanized, the sewage system was expanded, sustainable buildings were constructed, a cultural complex and social center that provides urban support were established, roads were constructed, more housing units were built and the plaza Ary Barroso was recuperated *ibid.*

The focus was the reduction of carbon emissions through sustainable practices such as LED lighting and rubbish sorting and collection.

In Babylonia, the government of Rio built 16 green houses and paved the area for an easier access to the community.

To the moment, the Morar Carioca has achieved the urbanization of 68 favelas, providing direct benefits to more the 65,000 homes (CCLA, 2013).

There is currently a juncture in Brazil between the need to supply the needs of housing demand through financing mechanisms and subsidies for the provision of homes, and the implementation of sustainability practices in housing developments. According to ONU-Habitat (2013), the government has worked in the development of the necessary financial incentives so the private sector participates in the construction of low-income houses for the poorest sectors, and has worked in creating mechanisms for the perception of economic benefits.

On the other hand, the government has oriented its housing policy in order to incentivize the voluntary adoption of certification systems for sustainable social housing developments, obtaining the first successful results. During this process the future development of monitoring systems that allow the measurement of results of the implemented sustainability measures is important in order to strengthen the green building business case, and progress towards a condition where the parameters established in such certifications become the new constructive paradigms in housing developments.



# Social Housing in Colombia

## Context

In 2009 the country presented a housing deficit estimated on 13 % (1,200,000 houses) and a great number of informal settlements (15 % of the urban homes) that don't have an adequate provision of public services or basic sanitation (PND, 2010). In relation to this, one of the objectives established in the National Development Plan (NDP) of 2010-2014 is the development of friendly houses and cities and to incorporate environmental sustainability, urban, and risk management parameters for the development of cities, in alignment to the Millennium Development Goals *ibid*. Such parameters consist on the following: densification, urban renovation, and controlled expansion; Integral Neighborhood Improvement program; provision of social sustainable housing; efficient mobility systems and alternative transport; efficient use of energy; access to basic sanitation and water, and sustainable building (PND, 2010).

One of the first programs established was the PROURE (National Program for the Rational and Efficient Use of Energy and Renewable Energies) that seeks to promote the rational and efficient use of energy and other non-conventional forms of energy that contribute to ensure the energy supply, Colombia's economic competitiveness, protection to consumers, and the promotion of renewable energies, considering environmental sustainability (PROURE, 2010).

In its section SR-4, the plan establishes the development of an energy efficiency sub-program focused on the social housing sector that seeks to improve users' quality of life, through the use of adequate and thermal materials, improved lighting and the use of energy efficient appliances (MME, 2010). Some of the most important action lines related to social housing are:

- (a) Development of energy efficiency technical standards for social housing, and to adopt regulations of design, construction and sustainable and efficient use of resources in constructions.
- (b) Development of bioclimatic systems for social houses, integrating energy efficiency concepts and renewable energies. (c) Development energy efficiency pilot projects for urban dwellings.
- (d) Development of a pre-payment program of energy sale for low-income neighborhoods and the rural sector (MME, 2010).

## Lessons Learned

In 2011, a series of technical guides to assist social housing developments was published, where applicable norms for social housing developments were established. The norms that are currently applicable to the development of social housing developments are:

- Regulation for earthquake resistant buildings (NR-10)
- Technical regulation of potable water and basic sanitation (RAS-2000)
- Colombian Technical Norm, ntc 1500. Colombian Code of Plumbing – Best practice recommendations.
- Technical regulation of electric installations – RETIE
- Manual for technical construction specifications – Best practice recommendations.
- Technical regulation of aqueduct pipes and sewage.
- Technical Guideline of Energy Efficiency for Low-Income Housing (RETEVIS)

As mentioned in Colombia's chapter, one of the main instruments related to sustainability in social housing is the RETEVIS. This technical guideline has the objective of specifying the necessary actions to direct the construction process of the social housing sector towards the rational use of energy and of defining parameters, levels, indicators, calculus, methods, and energy efficiency measurements (MAVDT, 2011).

The RETEVIS is developed under the concept that a low-income house can be considered to be energy efficient if energy is efficiently used through its whole life cycle and the construction guarantees comfort conditions for its users.

The guide, *Applicable Norms in the Development of Low-Income Houses*, incorporates the RETEVIS, based on article 3 of the 2501 Decree of 2007, which establishes the technical parameters of efficient and rational use of energy to be applied in the design and construction of social housing projects, which are funded with subsidies of the national budget (MAVDT, 2011). Some of the initiatives established by the guide that have been implemented are:

- The enactment of regulations for electric installation (RETIE) and for illumination and street lighting (RETIE) have been achieved. They incorporate requirements regarding energy loss in electric installations and energy efficient lighting systems.
- It has been agreed to define aspects for bioclimatic management and energy use in houses such as: air conditioning, water pumping, dispositions that ensure the efficient use of energy for cooking, water heating and refrigeration.
- The medium-term plan is to develop a more ambitious framework that considers different types of dwellings under a new regulation that considers a deeper understanding of the energy consumption of the used materials and of the construction process.

Also, as it was previously mentioned in the Colombian chapter, the National Saving Fund's Seals are in development process and they propose incentives for the construction of more sustainable houses. Furthermore, the Colombian Environmental Seal for Green Buildings is also in development process and in its second phase will focus on the normalization of standards for the housing sector.

In 2011 the RETEVIS was officially incorporated into the technical norms for social housing construction, and through the development of sustainable construction codes and guidelines, it is expected that in the coming years, Colombia will implement broader practices of sustainable building in the social housing sector.

Some of the social housing projects where sustainability practices and sustainable urbanism have been implemented are: Ciudadela Maiporé, which focuses on social, environmental and ecologic aspects, and also procures the universal access to transport and basic services. Also, the second generation National Low-Income Macro Projects, which are vertical constructions developed with the objective of meeting the existing housing demand, considering land planning and terms of reference for the development of pre-feasibility environmental assessments.

The NDP 2010-2014 contemplates the incorporation of public policies that incentivize the implementation of sustainability principles in social housing developments. In this sense, it can be said that sustainable building is among the main interests of the public policy agenda, and that the government is currently working on developing the respective regulative frameworks.



*Sayab - Awarded as the Most Sustainable Residential Complex in Colombia. (Source: architectu-relist.com)*

# Sustainable Social Housing in Chile

## Context

It is estimated that in 2011 the housing deficit increased 17.8 % going from 420,587 housing units to 495,304 between 2009 and 2011, mainly in the areas affected by the earthquake of February 2010 (CASEN, 2011). Chile is the first Latin American country to have a general Sustainable Building National Strategy, which integrates some lines of action in relation to the development of sustainable social housing, which are:

- To increase the availability of residential buildings with sustainability criteria
- To increase the number of state subsidies granted for the acquisition of new houses or for the reconditioning of existing ones, incorporating sustainability considerations.
- To promote the implementation of efficient heating, refrigeration and hot sanitary water systems for houses.
- To promote the installation of waste receptacles in public spaces in all communes, and the separation of solid and organic waste in collective buildings and housing.
- To generate national codes and standards adapted to the local context.
- Development of a roadmap to update referential and mandatory norms.

The Energy National Strategy (ENS) 2012-2030 is a central policy in the country and establishes the goal of reducing 12 % of the energy demand for 2020, assigning the building sector approximately 20 % of the total savings (Pavón, 2013). To achieve this, the State has increased the budget destined to energy efficiency programs. A relevant initiative in the social housing sector is the Housing Energy Rating System, which is a voluntary instrument that evaluates energy efficiency levels in new homes during their operation stage, considering heating, lighting and hot potable water requirements (MVU c, 2013). The system allows users to know the energy efficiency levels of the house they want to purchase. This program turns Chile in a pioneering country in the region for the implementation of energy efficiency labels in the social housing sector.

Similarly, as part of the actions to achieve the energy efficiency goals, in 2006 by initiative of the Ministry of Housing and Urbanism, the Protection Program of Family Patrimony created two subsidy lines that respond to energy consumption indicators.



One that consists of subsidies for thermal reconditioning of existing social houses, and another one for innovative energy efficiency projects that promote the implementation of solar collectors, solar lighting and wastewater management or similar (MVU a, 2013).

Also, the Sustainable Dwelling Code was published in 2013 and will be available for voluntary implementation starting in 2014. The code addresses a variety of topics for the design, construction and operation stage of houses (MVU b, 2014). Initially, the code will be voluntarily applied, however mandatory elements will be incorporated gradually. Moreover, it is expected that by 2016, all new social houses will be built according to the code's standards (GOVUK, 2013). The code contemplates the following categories:

**Energy:** Housing Energy Rating System; envelope insulation standard – standard for sealing, walls, floors and windows; infiltration rate; efficient heating and air conditioning systems; interior and exterior lighting standards; renewable energies standards; efficient appliances and energy monitoring.

**Waste:** Minimize waste in the building construction stage; reuse of excavation and demolition materials; use of recycled aggregates; commitment to eradicate non-authorized waste disposal; avoid sending rubbish to landfills by sorting it for recycling; technical training and sorting of household waste.

**Health and Wellbeing:** Indoor air quality; thermal comfort; acoustic performance; security; visual comfort; drying space for clothes; access and security; risks and private exterior space.

**Others:** user's guide; responsible building; life cycle impacts; nitrogen oxide emissions; impacts of refrigerants; light pollution; public transport accessibility and alternative transport.



*Housing before and after thermal conditioning. one of the Program grants Homestead Protection (Source: serviumagallanes.cl)*

## Lessons Learned

Besides the development of planning instruments and the Sustainable Dwelling Code, the implementation of energy efficiency measures have been achieved. In February 2014, a project of 50 low-income houses, in the commune of Freisa, obtained the Energy Efficiency Certification, becoming the first houses to be labeled as energy efficient in the region (MSGG, 2014). The certification allows users to confirm that houses have an improved insulation system and that they are environmentally friendly, which in turn, is reflected in the user's quality of life. The intention is for the Housing Energy Rating System to be replicated in other communes of the region for both social housing projects and private projects *ibid*.

Another implemented energy efficiency project was carried out in the region of Bío Bío where subsidies for thermal reconditioning were granted for social houses, through the Protection Program of Family Patrimony. The subsidies were granted in 2009 to houses that were built before 2007, and that didn't comply with current thermal insulation standards, with a total of 7,965 granted subsidies to 2013 (Cáceres et al. 2013). According to an energy evaluation, it was determined that the temperature inside the reconditioned houses had an improvement between 0.6 to 1.1 degrees Celsius. It was estimated that this increase is quite significant if it's considered that to artificially increase this amount of temperature it would be necessary to increase the energy consumption by about 15 %. It was also found that houses showed a reduction of 20 % to 33 % in heating *ibid*.

Similarly, in the Tenuco commune the project, Committee Quality of Life Improvement consisted in the thermal reconditioning of 70 houses, where savings of about 35 % in heating demand were obtained (MVU, 2011).

Chile has made significant progress in terms of sustainable social housing. There implemented energy efficiency projects, and the Housing Energy Rating System positions the country as a regional pioneer. Additionally, regulations have been established to implement new thermal conditioning parameters for new houses and subsidies that allow thermal reconditioning of existing houses.

Also, Chile has a clear vision for the implementation strategy of the Sustainable Dwelling Code. In the coming years incentives will be developed for the code's voluntary implementation, however mandatory implementation of certain parameters is contemplated for the future. From 2016 the code will be implemented in new low-income projects, which also positions Chile as a leader in the sector. The solid structure Chile is building in terms of sustainable social housing, can allow the country to join international markets in the NAMA or CDM schemes for the financing of energy efficiency projects.

# Sustainable Social Housing in Mexico

## Context

It is estimated that there is a housing deficit of approximately 8 million units (Tapia, 2014). Additionally, it is projected that from 2011 to 2030 the construction of almost 11 million housing units will be necessary and that about 9 million dwellings will require total or partial renovation in the same period (INEGI, 2010, CONAPO, 2013 cited in ENVS, 2013). The Housing Law was promulgated in 2006 to face the housing demand challenges and establishes guidelines for the development of social housing, incorporating sustainability parameters, institutional coordination, and relation with the private sector (ENVS, 2013). In its sixth article, the Housing Law establishes sustainability guidelines such as mechanisms to procure environmental care and the efficient use of energy and natural resources (Ley 2612, 2006).

In December 2007 the National Housing Commission (CONAVI) published the Housing Building Code with the objective of regulating the construction process in the housing sector. In 2010 sustainability parameters were incorporated establishing minimum standards, with the aim of reducing negative environmental impacts (CONAVI, 2010). Furthermore, the National Strategy of Sustainable Housing (NSSH) aligns and formulates short, medium and long-term objectives of the currently implemented sustainable housing social programs and it establishes three action lines for its achievement:

- 1) Financing
- 2) Housing evaluation and
- 3) Standards definition.

There are more than 50 norms related to energy efficiency and water consumption for the social housing sector (ENVS, 2013). Some of the norms currently in place, applicable to the development of sustainable social housing are:

- NOM-020-ENER-2011 – Energy efficiency in buildings, building envelope for residential use.
- NOM-021-ENER/SCFI-2008 – Energy efficiency, user security requirements in room air conditioning systems.

- NOM-023-ENER-2010 – Energy efficiency in divided and free discharge air conditioning systems without air ducts.
- NOM-24-ENER-2012 – Thermal and optical characteristics of glass glazing systems for buildings.
- NOM-011-ENER-2006 – Energy efficiency for central and individual air conditioning systems.
- NOM-018-ENER-2011- Thermal insulation for buildings. Characteristics, limits and test methods.
- Norma Federal NMX-AA-164-SCFI-2013, Sustainable Building – Minimum Environmental Criteria and Requirements.

The NSSH takes current energy efficiency and water consumption standards as a baseline to establish minimum levels that social houses and new products must comply with. Furthermore, it seeks to incorporate new norms that are more modern, integral and stringent, and that establish new minimum environmental performance parameters (ENCS, 2013).



*The ECO CASA program involves the construction of 27,000 efficient homes in Mexico, which will reduce emissions of greenhouse gases in the country. (Source: cedu.com.ar)*



## Lessons Learned

Mexico has achieved significant progress in the development of energy efficiency policies and programs for the social housing sector. Initially, through the Green Mortgage program, basic energy efficiency solutions that consisted in the installation of eco technologies were implemented. However, objectives have recently been extended to consider houses with an improved location, a vertical structure, and water and energy efficiency. Furthermore, through the Housing Energy Rating program an energy efficiency certification is under consideration for new dwellings.

Social housing programs are in constant evolution. Such is the case of the Green House Evaluation System (SISEViVe – Eco Casa), (the next stage of the Green Mortgage program), which is an indicator system to measure energy performance and environmental impact of houses, and it's employed as an additional way to drive and direct incentives and resources towards the social housing sector. Similarly, program progress is also noticeable in the Program Activity of the Clean Development Mechanism, named Specific Program for the Sustainable Housing Development to Face Climate Change, which is in the process of transitioning into the NAMA scheme. Under this scheme, housing projects will be able to receive additional financing to improve energy efficiency, to reduce the use of fossil fuels and water, which will be achieved through the use of eco technologies, improvement in the architectonic design and the use of efficient construction materials (CONAVI, 2012).

As presented in Mexico's chapter, some of the most relevant cases where energy efficiency policies have been implemented in social housing projects are the Mexico-German NAMA program – Housing Component – which designed three models of sustainable houses for Mexican construction companies to test; Eco House 1 (similar energy efficiency

levels to Green Mortgage program), Eco House 2 (higher levels of energy efficiency) and Eco House Max (minimum heating and cooling demand). These are co-financed pilot projects used to test NAMA concepts and used to refine the designs, and demonstrate their feasibility. Similarly, the ZEH, Zero Energy Houses Mexico project, shows in their results that energy performance can improve up to 24 % when implementing solutions such as double insulation on walls and ceilings, double-glazed windows and improved hermetic solutions, among others.

The Integral Sustainable Urban Developments (DUIS) promote integrally planned regional, urban and local areas. To date there are 12 DUIS certified projects in Mexico, equal to 430,028 houses for 555,154 people. Similarly, there are other four projects in evaluation process and other 10 in pre-evaluation process. A DUIS project that is currently implemented is the Urban Regeneration of the Historic Center of Puebla.

Mexico has achieved the development of a solid institutional structure for the social housing sector. The NSSH is a clear proof that sustainable social housing is a priority national interest, and that the state has established a clear long-term vision for the institutionalization of sustainable practices in the sector. Besides the remarkable progress on energy efficiency initiatives, the Federal Norm NMX-AA-164-SCFI-2013, Sustainable Building – Minimum Environmental Criteria and Requirements is an instrument that incorporates a broader vision of sustainability in buildings and that also is applicable to the social housing sector.

# Sustainable Social Housing in Peru

## Context

Peru presents a housing deficit of approximately two million houses, from which about 20 % corresponds to a quantitative deficit (about 400,000 houses) with an annual growth rate of 100,000 units per year (Gutiérrez et al., 2010). Qualitative housing deficit refers to existing houses that have inadequate physical characteristics and/or are located in overcrowded locations; these ascend to over 1,242,321 housing units (MVCS, 2008). Most of the housing demand is concentrated in the low and middle-income segments of society, which means that social housing developments have great potential for this market (Gutiérrez et al., 2010).

The National Housing Plan 2006-2015: Housing for All, and the Bicentenary Plan are the policy instruments that address housing challenges in Peru. Their main objective is housing deficit reduction, and to meet the housing demand derived from the creation of new families. Peru has faced the social housing challenge through mortgage subsidy programs. One of the main programs developed by State is the mortgage credit program, My House Fund, which currently grants 25 % of the total mortgage credits (CAMACOL, 2011). The government has established the goal of building 500,000 houses in the next years, and plans to grant between 100,000 and 120,000 housing subsidies per year *ibid*.

One of the policy frameworks, applicable to the social housing sector is the Law for the Promotion of the Efficient Use of Energy, which establishes the following dispositions for the sector:

- Establishment of adequate financing mechanisms for the replacement of low-energy efficiency equipment.
- Implementation of activities to improve consumption habits and the use of efficient appliances via the promotion of adequate information.
- Periodic evaluation of consumption habits.
- Promotion of the use of efficient technology.
- Development of a monitoring protocol to measure the quality of wastewater treatment plant effluent from municipal and domestic water.

El Plan Referencial del Uso Eficiente de la Energía 2009-2018 establece en sus líneas de acción para el sector público el objetivo de crear programas estatales de vivienda social que incorporen el uso de equipos eficientes (focos ahorradores, calentadores a gas o solares, etc.), sin embargo aún se encuentra en proceso de desarrollo (MEM, 2009; FES, 2012).

The Referential Plan for the Efficient Use of Energy 2009-2018 has the objective of implementing the dispositions established in the Law for the Promotion of the Efficient Use of Energy, and establishes among its lines of actions for the public sector, the objective of creating institutional programs for the social housing sector, which incorporate the use of efficient equipment (efficient lamps, gas or solar heaters, etc.), however, to date the program has not yet been developed or implemented (MEM, 2009; FES, 2012).

Similarly, article 24 of the National Environmental Policy establishes that all human activity that involves construction, works, services and other activities that could cause significant environmental impacts are subject to the dispositions of Law of National Environmental Impact Evaluation System, which mandates construction projects to comply with the Environmental Certification. This certification is granted when building projects comply with the established parameters, which are mostly related to water management solutions.

The Regulation for Environmental Protection derives from the Sectorial Environmental Policy of Housing and was developed to regulate activities related to housing, urbanism, construction and sanitation. Its objective is to regulate sectorial environmental management, ensuring the adequate implementation of the National Environmental Policy and to prevent, mitigate, control, and remedy environmental impacts derived from activities and projects related to the functions of the Ministry of Housing, Construction and Sanitation (Decreto 015, 2012). The norms approved by the Regulation include (MVCS, 2010):

- Sectorial Environmental Policy - RM. No. 165-2007 –Housing

It seeks to strengthen the policy framework for the development of the Environmental Management System and establishes specific objectives for the social housing sector, which are:

1) promote sustainable urban and rural development;

2) control environmental quality in urban and rural environments through best practices, technological innovation, and social responsibility from involved organizations, in order to guarantee the right to a healthy environment; and

3) to incorporate traditional knowledge into urban and rural sectorial activities.

- Sectorial Environmental Management Plan - 2008-2016 RM. 218-2008- Housing
- Regulation parameters for fecal coliforms for wastewater treatment plant effluents - D.S. No. 042-2008-PCM
- Maximum admissible values for discharge in the sewage network – D.S. No. 023-2009- Housing

Other initiatives linked to the social housing sector, which are currently in development process, are the approval of the Regulation for Solid Waste from Construction and Demolition, and the guidelines for the development and modification of the Environmental Management Program –PAMA- for potable water and sanitation projects.

Also, in August 2013, in the context of the project, Development and Implementation of a Sustainable Housing Code in Peru, a group of representatives from the Ministry of Housing, the Building Research Establishment and other organizations, met for a panel discussion called Sustainable Housing Codes (MVCS, 2013). The objective of the discussion was to share the British experience on the development and implementation of their sustainable building code, while the Peruvian government shared the challenges they face upon the creation of their own sustainable building code (Embajada Británica, 2013). The project considers the revision of the current legislation, the national context, and an evaluation of the potential implementation of the code in the national market, and finally, the revision of international policies for the development of a basic guide that sets a model for a local sustainable housing policy (MVCS, 2013).



*First sustainable housing and low carbon emissions in the city of Iquitos. (Source: minam.gob.pe)*



## Lessons Learned

Regarding social housing projects that implement sustainability aspects, the projects Save Energy, Save the Planet 1,2 and 3, developed under the NAMA scheme, propose energy efficiency solutions that consist in the substitution of conventional incandescent lamps for fluorescent lamps. All homes that are registered as clients of the company Hidrandina are eligible to participate in the program that is valid from 2010 to 2016. With this action, the project estimates an accumulated reduction equivalent to 129 766 Tn Co<sub>2</sub> e. Project 2 and 3 have the same objective, but are located in different places, have a different reduction goal and the number of lamps that will be replaced is also different.

In the case of the project Hot Clean House K'OÑICHUYAWASI, presented in the case study section in the chapter of Peru, broader sustainable aspects were implemented to houses in the rural sector. Technologies such as hot wall, an insulation system and improved kitchen, were implemented under the scheme of Appropriate Technologies that is based on the following characteristics: they are environmentally friendly because they use renewable resources and don't harm ecosystems; they effectively provide solutions to a concrete domestic need; they are low-cost solutions, easy to understand, manage and maintain, thus, they are replicable in the local scale (GASR, 2012).

Through the presented policies, norms and study cases, it can be easily appreciated how Peru, in comparison to other countries, is still behind both in the development of sustainable building policies for the social sector and in the implementation of energy efficiency measures in the sector. Although the Sectorial Environmental Management Policy is in place, guidelines and regulations to implement sustainable building practices have not been developed, nor have norms to regulate minimum energy efficiency standards in houses. Also, there are no building codes or regulations for sustainable building that take a more holistic approach on practices. However, the project, Development and Implementation of a Sustainable Housing Code in Peru that evaluates current norms for the development of a sustainable housing code was recently began its implementation and could be an important achievement for the country.

# Sustainable Social Housing in Guatemala, Panama and Costa Rica

## Most relevant Initiatives

The project, Promotion of Energy Solutions in the Design and Implementation of Human Settlements - Regional Guidelines for Sustainable Housing Planning, Design, Construction and Financing, is developed through the Central American Committee of Housing and Human Settlements with the technical assistance of the Secretariat for Central American Social Integration (CCVAH, 2013). The general objective of the project is the development and regional promotion of technical guidelines for the design, construction and location of energy efficient housing developments that reduce vulnerability and promote a more adequate use of land, incorporating adaptation and mitigation to climate change criteria (CCVAH, 2013).

Countries that form part of this project are: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama and Dominican Republic. The technical guidelines for the design, construction and location of energy efficient housing were defined through participative discussions. The defined guidelines are the following:

- Energy efficiency in housing: planning, design, construction, and financing.
  - Climate zoning based on the Köppen system, used for the implementation of guidelines.
  - Planning guidelines: planning areas.
  - Guidelines for design and construction according to the climate zone: tropical savanna, high mountain zone, and rain forest.
  - Financing: individual funds via collection, external funds, social contributions, access to social housing, measures to reduce social housing costs and financing recommendations for social housing construction.
- Housing and renewable energies: photovoltaic panels, wind generators, solar collectors for water heating, firewood stoves for food cooking, and bio digesters for gas kitchens.

After the guidelines were defined, an analysis was carried out in order to determine the current situation of each country regarding their social housing policies and their possibility to implement the Regional Guidelines for Sustainable Housing (CCVAH, 2013, pg. 106):

## **Guatemala**

### Strengths:

- Authorities are willing to work in the development of social housing projects that incorporate energy efficiency and bioclimatic architecture.
- The Law of Housing and Human Settlements has been recently approved.
- There is a financing line available for low-cost projects through the Insured Mortgage Fund.
- There are technical norms available for low-cost building.

### Weaknesses:

- There is a minimum amount of available financing sources to implement sustainable building and bioclimatic architecture solutions.
- There is little clarity about inter-institutional capacities for the social housing sector.
- Inter-institutional capacities are not clearly defined.
- There are available national policies for the housing sector, but they are rarely applied.
- The government provides minimum support for environmental issues.
- There is a weak legal framework for the housing sector.
- Housing policies are ambiguous.

## **Panamá**

### Strengths:

- The government complies with social commitments: The Solidary Fund exists and it's currently being implemented.
- There is a metropolitan development plan for the city of Panama and Colon.
- There is political will for the construction of social housing projects that consider climate change adaptation, mitigation and risk management.
- There is an available regulation for disaster risk management.
- There is political will for the construction of housing projects that consider energy efficiency and bioclimatic architecture.
- There is a specific regulation for the use of renewable energies and incentive and subsidy implementation; e.g. Law 69.
- The Law of Preferential Interest facilitates low-income families to pay less for their houses.
- The regulation for the efficient use of energy and rational use of renewable energies in buildings is currently being implemented.
- Currently, the economic scenario is positive, which incentivizes foreign companies to invest in the social housing construction sector.

### Weaknesses:

- There is a need to implement planning measures to address social housing in informal settlements.
- Social housing regulations require updates.

- There are un-planned human settlements, which create serious problems for city re-ordering.

## **Costa Rica**

### Strengths:

- The country has a strong financing system and the BANHVI grants housing bonuses.
- The country has an institutional structure that addresses the social housing sector.
- The country has institutional operational structures for the housing sector.
- There is easy access to financing for the acquirement of social housing.
- There is available legislation for the construction sector and professional experts on the subject.
- There is a consolidated financing national system for housing, with the necessary affiliations and a social fund for housing.
- The country has a functional system for sustainability in the housing sector.

### Weaknesses

- There is an excess of administrative procedures for the approval of housing projects, which makes the process more expensive.
- There are serious problems of inefficiency to obtain property certifications.
- In many cases, government agencies linked to the social housing sector are not coordinated.
- The government's budget is limited to invest in social housing projects.
- There is a need of urban planning legislation.



# State of Play of Sustainable Building in Latin America

## Conclusions and Recommendations

The present report provides a general view of the situation of the green building industry in nine Latin American countries that include: Argentina, Brazil, Colombia, Chile, Mexico, Peru, Guatemala, Panama and Costa Rica. It gathers policies, norms, regulations, programs, research organizations, and implemented and developing initiatives linked to building energy efficiency and sustainable building.

The report doesn't intended to be exhaustive and it's recognized that the presented initiatives are not the only efforts that are being carried out in the countries. It was found that at the local level, states and municipalities are also carrying out important initiatives for the development of policies and programs that promote energy efficiency and the use of renewable energies in buildings and other sustainable practices. Although the report gathers government's initiatives from the national level, it is acknowledged that local governments, the private sector, NGOs, and the civil society have made important contributions that are not mentioned in this report.

The national contexts of the nine analyzed Latin American countries present some notable similarities: housing deficit is an issue present in all countries, making the need to meet housing demands a national priority to address.

There is a growing tendency in the demand for electric energy due to the rapid economic and urban growth in the region. In general, it is found that the residential and industrial sectors consume most of the energy demand in the region, followed by the commercial and public sectors. As a consequence, there is a need for the development and implementation of measures to promote energy efficiency in all sectors.

The construction sector is a central pillar of the national growth strategies in the nine Latin American countries, presenting generalized growth trends. In the region, the construction sector represents between 2 % and 15 % of the national GDP, with the construction sector in Guatemala the one with the least contribution to the national GDP and the construction sector of Panama, Brazil, and Mexico among the most buoyant construction sectors in Latin America.

All countries have established national priorities related to the social and economic development; quality of life improvement for the general population, adequate housing supply, and the provision of basic services, among others, are priority actions established in all countries. Furthermore, the nine countries are part of the international commitments of the UNFCCC and the Kyoto Protocol, establishing voluntary reduction goals of GHG and CO<sub>2</sub> emissions.

To achieve this, most of the analyzed countries have developed a national climate change strategy, where in a generalized way, the energy sector is a central pillar of the climate change mitigation strategy. In this sense, at the national level energy efficiency is the most promoted measure to achieve the reduction of CO<sub>2</sub> emissions and as a measure to obtain economic benefits, both at a national level and in family households. In some cases such as Mexico, Brazil, Colombia, Chile and Panama the implementation of energy efficiency practices in buildings are explicitly considered as a climate change mitigation strategy and in the case of Costa Rica, it is also presented as an adaptation measure.

The nine Latin American countries are currently in different stages of development and implementation of their public policies, strategies, and sustainable building plans. Each country has developed their sustainable building agenda according to their local needs, national development priorities, local and economic possibilities, and to the available international support and mechanisms, among other factors. To determine the current situation of the sustainable building sector in the Latin American region, the report gathered policies, norms and programs in two main subjects: energy efficiency solutions in buildings and sustainable building practices. Meaning practices where besides incorporating energy efficiency measures, a wider perspective is included with elements such as: efficient water management, air quality, use of sustainable materials, social wellbeing, waste, connectivity and site selection among others.

A list of key initiatives was selected from the information collected for each country, in order to determine the current situation of building energy efficiency and sustainable building.

The selected key elements are the following:

### **Key building energy efficiency policies and initiatives**

- Energy efficiency labeling / certification for the social housing sector.
- Subsidy or incentive programs to implement energy efficiency solutions in social housing (design, construction and operation – eco technologies, bioclimatic design, thermal reconditioning, etc.).
- Programs for rational use of energy in non-residential construction (with focus on envelope improvement, and efficient lighting and refrigeration).
- Projects under the CDM and/or NAMA scheme focused on building energy efficiency and renewable energies.
- Implemented social housing projects that incorporate energy efficiency solutions.
- Energy efficiency technical standards for buildings (that include one of the following: thermal conditioning, thermal insulation, envelope and/or bioclimatic design).
- Energy efficiency law.

Table 9.1 presents the progress made in the nine countries regarding building energy efficiency policy, programs and initiatives (letter D indicates that the policy or program is in developing stage; ? indicates that there is not enough information to determine if the country complies with the element or not; NO indicates that the country has not developed the measures and YES means the country has made progress).

The region has achieved a generalized progress in the development of laws to promote the rational and efficient use of energy, becoming in all countries a central and priority national policy.

The study shows that for the nine countries it has become a priority to promote the efficient use of energy by establishing national strategies to achieve economic savings that benefit society, that ensure the national energy supply, and that at the same time, contribute to GHG and CO2 reductions. The development of programs for the rational use of energy has become a support mechanism for the implementation of energy efficiency laws.

These programs plan and execute strategic actions for the implementation of energy efficiency solutions in low-income houses and in commercial, public and residential buildings.

It can be noted that Argentina, Mexico, Brazil and Chile have a consolidated energy efficiency policy framework.

The four countries have developed energy efficiency technical standards that establish minimum building requirements in at least one of the following topics: building envelope, thermal conditioning, passive design, eco technologies and efficient lighting and refrigeration systems. Furthermore, the four countries have developed their building codes or guidelines that regulate the use of technical standards to achieve energy efficiency in low-income houses.

Or on the other hand, they have local building codes that allow the voluntary incorporation of the energy efficiency technical standards.

Chile can be seen as a pioneering country with the implementation of the Housing Energy Rating System, which is a voluntary instrument that evaluates the energy efficiency of new dwellings during their operation stage, considering requirements on heating, lighting and hot sanitary water (MVU c, 2013). The system allows users to know the levels energy efficiency of new houses they want to acquire. In February 2014, a project of 50 low-income houses, in the commune of Freisa, obtained the Energy Efficiency Certification, becoming the first houses to be labeled as energy efficient in the region (MSGG, 2014).

This makes Chile the first Latin American country to implement an energy efficiency labeling system for low-income houses.

On the other hand in Mexico in 2012 the Green House Evaluation System (SISEViVe - Eco casa) was developed as an indicator to measure the energy performance and environmental impact of dwellings, and as an additional way to drive and focalize incentives and resources destined for sustainable housing initiatives.

Table 9.1 The State of Play of Energy Efficiency in Buildings in Latin America.

	The State of Play of Energy Efficiency in Buildings in Latin America								
	Argentina	Brazil	Colombia	Chile	Mexico	Peru	Guatemala	Panama	Costa Rica
Energy efficiency labeling / certification for social housing	D	YES	NO	YES	YES	NO	NO	NO	NO
Energy efficiency guideline/code for social housing	YES	YES	YES	YES	YES	D	D	D	D
Subsidy and/or mortgage credit programs to incorporate energy efficiency solutions in low-income housing (design, construction and operation stage - eco technologies, bioclimatic design, thermal conditioning, etc.)	D	YES	D	YES	YES	NO	D	D	YES
Programs for the rational use of energy in buildings (with focus on the improvement of the building envelope and/or efficient lighting and refrigeration system)	YES	YES	YES	YES	YES	YES	NO	YES	NO
CDM and/or NAMA projects focused on building energy efficiency (efficient lighting and/or renewable energies)	YES	?	YES	YES	YES	YES	?	?	?
Implemented social housing projects that incorporate energy efficiency measures.	YES	YES	YES	YES	YES	NO	D	D	D
Energy efficiency technical standards for buildings that include at least one of these topics: thermal conditioning, thermal insulation, building envelope and/or bioclimatic design.	YES	YES	D	YES	YES	D	NO	D	NO
Energy Efficiency Law	YES	YES	YES	YES	YES	YES	D	YES	YES

The evaluation system is based on parameters such as bioclimatic design on buildings, constructive systems, material characteristics and implemented eco-technologies.

Energy demand, water and energy consumption, and sustainable characteristics are measured through these indicators.

Similarly, in Argentina, with the objective of adequately implementing the Thermal Conditioning Law and the Energy Efficiency Law, the Ministry of Infrastructure developed a pilot project called "Design, Construction and Labeling of Energy Consumption", which sets in motion the first bioclimatic social houses in the province (SSTUV, 2014).

The aim is for them to be first social houses in the country with an energy certification and that the implemented measures are above the required parameters by the IRAM thermal conditioning norms *ibid*. The pilot project consists of the construction of four houses in the municipality of Tlapalqué where the following bioclimatic schemes are implemented: cross ventilation, thermal insulation, direct solar radiation capture, natural lighting, flat solar collector, photovoltaic system, wall heating system, solar radiation control, and hot air generation (Instituto de la Vivienda, 2013).

Argentina, Brazil, Chile, Mexico and Costa Rica have developed subsidy and/or mortgage credit programs to incorporate energy efficiency measures to social housing projects, however, Mexico and Brazil present the most developed and consolidated programs.

In the case of Mexico, the credit program Green Mortgage is an international model for best practices, where the government grants an additional credit to users that want to acquire a house with energy and water efficient equipment (ENVS, 2013).

The program includes diverse credit schemes, which vary according to the dwelling's climate zone.

The schemes include: efficient light bulbs, solar heaters, roofs with thermal insulation, high-efficiency air conditioning and heating systems, efficient faucets and showers heads, and double discharge WCs, among others.

The program constantly transforms and improves. For the next stage the program Green House Evaluation System (SISEVIVE - Eco casa) was developed to confirm evaluation criteria and to support the decision-making processes in topics such as incentives and housing programs that consider energy efficiency, comfort and environmental friendly aspects.

In the case of Brazil, the program Minha Casa, Minha Vida is promoted by the federal government to subsidize the construction of nearly 3 million low-income houses by 2014. In the first phase of the program (2009-2010), one million houses were built and subsidies were included for the voluntary installation of solar heating systems, with the objective of reducing carbon emissions. For the second stage (2011-2014), where 2 million houses will be built, it is mandatory for all units to incorporate solar heating systems (TWBG, 2011).

In 2006 through the Protection Program of Family Patrimony the Chilean government created two subsidy lines that respond to energy consumption indicators. One line subsidizes thermal conditioning in existing buildings and the other subsidizes energy efficiency innovation projects that promote the implementation of solar collectors, solar lighting and wastewater management systems or similar (MVU a, 2013).

The subsidies were granted in 2009 to houses that were built before 2007, and that didn't comply with current thermal insulation standards, with a total of 7,965 granted subsidies to 2013 (Cáceres et al. 2013).



Finally, the strengths and weaknesses analysis show that Costa Rica has a consolidated financing national system for housing, with the necessary affiliations and a social fund for housing and that the country has a functional system for sustainability in the housing sector.

On the other hand the analysis shows that Colombia has progressed in the development of the energy efficiency policy framework, nevertheless they are still developing some of the key elements. The building energy efficiency technical standards are still in a developing process, where the minimum energy efficiency limits will be established.

Likewise, the government is working on the development of the credit program Green Mortgage, which takes as an example Mexico's credit scheme.

The Technical Guideline of Energy Efficiency for Low-Income Housing was recently published with the objective of specifying the necessary actions to direct the construction process of the social housing sector towards the rational use of energy and of defining parameters, levels, indicators, calculus, methods, and energy efficiency measurements.

Peru, on the other hand has achieved the development and publication of the Referential Plan for the Efficient Use of Energy 2009-2018, which has the objective of implementing the dispositions established in the Law for the Promotion of the Efficient Use of Energy, and establishes among its lines of actions for the public sector, the objective of creating institutional programs for the social housing sector, which incorporate the use of efficient equipment (saving light bulbs, gas or solar heaters, etc.), however, to date the program has not yet been developed or implemented (MEM, 2009; FES, 2012).

Panama is also developing the disposition of the Law 69 of 2012 of Energy Efficiency, which stipulates the development of regulations such as technical norms for building energy efficiency that promote the energy savings from its design, including electric installations, air conditioning and refrigeration.

Furthermore the Strategic Plan for the Rational Use of Electric Energy proposes lines of action that include the development of energy efficiency technical norms, a labeling system and certification laboratories and the development of incentives and subsidies for the efficient use of energy in buildings.

Finally, Costa Rica, Guatemala and Panama are part of a regional initiative that since 2013 promotes the development of the project Promotion of Energy Solutions in the Design and Implementation of Human Settlements - Regional Guidelines for Sustainable Housing Planning, Design, Construction and Financing, which has the objective of the project is the development and regional promotion of technical guidelines for the design, construction and location of energy efficient housing developments that reduce vulnerability and promote a more adequate use of land, incorporating adaptation and mitigation to climate change criteria (CCVAH, 2013).

Thanks to this initiative it is considered that Guatemala, Panama and Costa Rica are planning the development of financing mechanisms and programs and the respective technical standards for the incorporation of energy efficiency solutions in social housing projects.

The three Central American countries are also part of the Regional Energy Efficiency Program where experiences are exchanged regarding normalization and development of incentives focused on energy efficiency in lighting and refrigeration equipment.

In order to evaluate the progress made for each country in sustainable building, the following key elements are considered:

### Sustainable building key initiatives:

- Sustainable Building National Strategy.
- National law that promotes sustainable building.
- Locally adapted certification tool for sustainable social housing.
- Locally adapted certification tool for sustainable buildings.
- Sustainable social housing projects under CDM/NAMA schemes.
- Subsidy and/or incentive programs to promote the integration of sustainable building elements in social housing projects.
- Subsidy and/or incentive programs to promote the integration of sustainable building elements in non-residential buildings.
- Sustainable social housing pilot projects.
- Sustainable building code (or guideline).
- Sustainable building technical standards.
- Law, decree and/or program that incentivizes green roofs.
- Compulsory environmental impact assessment.

Table 9.2 State of Play of Sustainable Building in Latin America.

	The State of Play of Green Building in Latin America								
	Argentina	Brazil	Colombia	Chile	Mexico	Peru	Guatemala	Panama	Costa Rica
Sustainable Building National Strategy	NO	NO	NO	YES	YES	NO	NO	NO	NO
National law that promotes sustainable building	NO	YES	D	YES	YES	NO	NO	NO	YES
Locally adapted certification tool for sustainable social housing	NO	YES	D	NO	NO	NO	D	NO	NO
Locally adapted certification tool for sustainable buildings	NO	YES	D	NO	YES	NO	NO	NO	NO
Sustainable social housing projects under CDM and/ or NAMA scheme	NO	?	NO	?	YES	NO	NO	NO	NO
Subsidy and/or incentive programs that promote the integration of sustainable building elements in social housing projects	NO	YES	D	YES	YES	NO	D	D	D
Subsidy and /or incentive programs to promote the integration of sustainable building elements in non-residential buildings	?	YES	D	D	YES	NO	NO	NO	YES
Sustainable social housing pilot projects	YES	YES	YES	?	YES	YES	?	?	YES
Sustainable building code (or guideline)	NO	?	D	YES	YES	NO	NO	NO	NO
Sustainable building technical standards	D	?	D	YES	YES	NO	NO	NO	YES
Law, decree and/or program that incentivizes green roofs	YES	YES	YES	YES	YES	YES	NO	?	YES
Compulsory environmental impact assessment	YES	?	YES	YES	YES	YES	?	?	YES

## México

Mexico stands out for its progress of both the development and the implementation of public policies to promote sustainable building, with special focus on the social housing sector.

The National Strategy of Sustainable Housing is a unique planning instrument in Latin America aligned with key national strategies that has the objective of maximizing the potential of the established social housing programs and aligning them in an integrated national strategy. Different instruments are used to establish sustainable building guidelines in Mexico, both for the social housing sector and for non-residential buildings. Some of these instruments are: The Sustainable Housing Building Code and the technical standard NMX-AA-164-SCFI-2013 – Sustainable Building – Minimum Environmental Criteria and Requirements, which are voluntarily applied.

Regarding laws that simulate sustainable building an example is the Financial Code of the Federal District (FCFD) that in its articles 293 and 294 establishes local incentives for sustainable building. It determines homeowners who implement eco-technologies are candidates for obtaining a tax reduction of up to 20 % on the rights to water supply.

The code also grants incentives to companies and organizations that have implemented official and verifiable environmental programs. Such companies are candidates to obtain a discount on salary taxes, which go from 30 % to 60 % of tax reduction.

There are also programs that grant incentives and subsidies for the implementation of sustainability practices in the social housing sector and in non-residential buildings. The Sustainable Building Certification Program (PCES for its acronym in Spanish) grants fiscal incentives such as discounts in property taxes

and construction licenses, to local buildings that obtain between 21 and 100 points of the required criteria for the development of new buildings and the operation of existing ones. The point categories are: energy, water, solid waste, life quality, social responsibility and environmental impact.

On the other hand, the program This is Your House allows the lower-income population to have access to a house, by granting subsidies for the purchase of a new or used home, to buy a lot for construction, or to rehabilitate existing houses. In 2009, for the first time, the program incorporated sustainability parameters that consider five categories: site analysis, efficient use of energy and water, waste management, and equipment and installation maintenance. In 2012 new operation rules were created for subsidy granting, which consider location, equipment, density and competitiveness.

Mexico is among the 10 countries with the most registered LEED projects. This certification scheme has been adopted with great market acceptance and its implementation has had a transformative effect in the real estate sector. Finally, the country is one of the first countries that have incorporated sustainable social housing projects under the NAMA scheme. In 2012, under the framework of the Mexico-Germany Program for NAMA of the World Bank, the GIZ provided the CONAVI with technical assistance for the development of the first NAMA for the social housing sector. It consists of an innovative approach for Mexico, as the program seeks the global performance of the house, considering a complete energy efficient performance for the housing unit (ENVS, 2013).

## Brasil

Similarly, Brazil shows important progress in the sustainable building sector. In order to prepare for the World Cup in 2014 and the Olympic games in 2016, the government has set ambitious goals to incorporate high sustainability construction standards to new sports stadiums and premises. This momentum has been seized in order to establish a long-term sustainability vision for the construction sector.

The country stands out for the development of a successful synergy between the use of voluntary certifications and regulatory frameworks that incentivize their use and implementation. There are a number of voluntary certifications and programs adapted to the local level that incentivize sustainable building practices. AQUA, Selo Azul da CAIXA, the Qualiverde Certification and the Referencial GBC Brazil Home are examples of successful instruments and programs to incentivize and classify the level of sustainability in buildings. Besides this instruments, Brazil is the fourth country in the world with more registered LEED projects, which is an indicator of the rapid growth of the green building industry.

Regarding laws to promote sustainable building, the presidential decree No.7746/2012 that regulates the third article of the 8.666 Law concerning institutional rules for bidding process and public contracts. The Decree mandates the use of sustainability criteria for the acquisition of public goods, including building contracts. To do so, it establishes sustainability as one of the main criteria to consider among the technical specifications of the bidding processes, for the acquisition of goods, services and construction projects. The decree also establishes the possibility to consider voluntary certifications as guiding and compliance tools that can assure that public authorities will acquire an energy efficient and low environment impact service, product or project (Decreto 7.746, 2012).

As in Mexico, there are legislations to promote sustainable building in the different municipalities of the country. An example is the city of Guarulhos, in the state of Sao Paulo, where according to the municipal Law No. 6.793/2010 buildings that implement one or two sustainable practices can reduce up to 20 % of the total property tax for a period of 5 years. The sustainable practices that can be implemented are: rain water storage; water treatment and reuse; solar heating systems; low-environmental impact materials for the construction phase; green roofs; waste recycling; and planting of at least one tree on the property (IPTU, 2014).

Regarding programs to incentivize the incorporation of sustainability elements in residential and non-residential building projects, in Rio de Janeiro, since 2012 the Qualiverde certification is promoted through the Decree 3.5745/2012, in order to stimulate the implementation of sustainable building practices through fiscal incentives. Rio de Janeiro's local government sets up Qualiverde on one hand as a voluntary certification (for new and existing buildings) for the implementation of sustainable building practices, and on the other hand as a program to offer fiscal and/or construction benefits to certified projects (Decreto 35745, 2012).

Finally, one of the existing programs to promote sustainable practices in social housing projects is the Selo Azul da CAIXA program. The program incentivizes, through financial mechanisms, social housing projects that contribute to the reduction of environmental impacts through the completion of criteria that considers urban quality, design and thermal comfort, energy efficiency, conservation of resources, water management and social practices (Caixa, 2010). Besides the financing program, CAIXA has developed a domestic building evaluation tool intended to certify the level of sustainability of housing developments.



## Chile

Chile stands out for the development of a structured policy framework to incentivize sustainable building. In 2013 Chile published the Sustainable Building National Strategy (SBNS), becoming the first Latin American country to have a transversal planning instrument that promotes sustainable building for both the residential and the non-residential sectors.

The SBNS 2013-2020 is a focal institutional instrument that establishes the counterpoints between sustainable building plans and strategic national plans, such as the National Energy Strategy 2012-2030 and its Energy Efficiency Action Plan 2012-2020, the Urban Development National Policy and the National Action Plan on Climate Change 2008-2012, among other national strategies and cross-sectorial plans. Furthermore, it approaches sustainable development from a holistic and integrated perspective. However, it's important to highlight that even though Chile has achieved great progress in the development sustainable building public policies, they are still in initial stages of implementation.

Sustainable building guidelines are developed under the framework of the General Law of Urbanism and Construction (Law No. 458), which establishes principles, attributions and faculties for urban planning, urbanization and construction (Cerdeira, 2013). In 2012 a Law Project was initiated to modify the General Law No. 458, to incorporate article 162, which compels construction companies to implement energy efficiency measures in new social housing developments (PDL 458, 2012). The enactment and publishing of the project law is still in process.

Finally, regarding available tools for the implementation of sustainable building practices, there are voluntary sustainable building technical standards available, and in 2014 the Sustainable Dwelling Code was published.

## Colombia

In Colombia, there are currently four main initiatives in a developing phase, to create green building norms, standards and codes which are: Energy and Water Efficiency Guideline for Buildings, Colombian Environmental Seal for Green Buildings, Seals of the National Saving Fund and the Technical Guideline of Energy Efficiency for Low-Income Housing. With the development of these four instruments, Colombia addresses the residential and non-residential sectors and establishes mechanisms to guide, incentivize and implement sustainable building practices in the country.

The National Development Plan of 2010-2014 (NDP) incorporates climate change as a central issue in the national public policy agenda and at the same time, recognizes the construction sector as an economic growth engine for the country. Some of the main strategies that derive from the NDP are the Climate Change National Adaptation Plan and the Colombian Strategy for Low Carbon Development, both still in a developing stage. Through these and other strategies such as the National Policy for the Consolidation of the City System, the National Policy of Urban Sewage, Public Policy of Eco Urbanism and Sustainable Building for Bogota and the Strategy of Sustainable Housing Habitat is that green building transversal strategies are being established to incorporate sustainable building in the public policy agenda.

According to the National Planning Department, other relevant initiatives to promote green building policy-making are (DNP, 2013):

- The inter-institutional sustainable building working table was created in 2012, where governmental agencies, non-governmental organizations and universities participate.

- Current initiatives of the inter-institutional working table are: development of the Energy and Water Efficiency Guideline for Buildings, Colombian Environmental Seal for Green Buildings, Seals of the National Saving Fund, Bioclimatic Guide of Housing and Urbanism, energy profile of buildings and a study on GHG emissions derived from urban housing.
- Development of public policies to procure environmental sustainability in buildings such as: environmental urban management policy, national policy for climate change, national policy for the consolidation of the city system, national policy of urban drainage, public policy of eco-urbanism and sustainable building for Bogota, and the Sustainable Housing Habitat Strategy.

Furthermore, through the agreement No. 186 of 2008 adopted in Bogotá, Capital District, the development of a sustainable building construction code based on existing certification systems is mandated (PDA, 2008).

## Argentina

Argentina has focused a great amount of effort towards building energy efficiency, however important progress has been made in the sustainable building sector. Currently IRAM is in the process of developing the sustainable building technical standard called Norma IRAM-ISO 15392, developed through the standardization of the ISO system of sustainable buildings (Evans, 2012). They are working on three main action lines for the implementation of sustainable building practices. The first one focuses on building and architectural design, which includes topics such as material selection, construction processes, energy efficiency, resource management, among others (IRAM, 2013). They use the following baselines: ISO TC 268 (sustainable development for communities), ISO TC 205 (Built environment), ISO 13153:2012 (Guideline for the design process of energy efficient single-family housing and small commercial buildings) *ibid*. They also include the compulsory IRAM technical standards related to thermal conditioning.

The second line of action is the standardization of environmental aspects of construction materials, by considering certifications or environmental labels of the products used for the construction, by performing a life cycle assessment. The third part of the standardization of the ISO system on sustainable building, takes as baselines the following systems: ISO 15392:2008 (General principles of building sustainability), ISO 21929-1:2006 (Guidelines for the development of sustainability indicators for buildings), ISO 21930:2007 (Environmental declaration of products), among others.

Furthermore, Argentina has developed social housing pilot projects that incorporate sustainability measures. An example is the project 70 Sustainable Houses for Villa Manuelita, where new housing prototypes were developed, which cover sustainability principles such as the selection of materials and energy efficiency. Three main elements define the housing design: environmental and low-cost material selection, energy efficiency measures for the construction and operation stages and the participation of the users in each and every step in order to create a strong feeling of involvement (UNR, 2010).

## Peru

Peru focuses its efforts in the development of policies that promote the rational use of energy and water, being behind in terms of programs that incorporate sustainable building norms and regulative frameworks. A consolidated program is the Environmental Certification Program, which is mandatory for all initiatives that imply an environmental impact. A construction project can obtain the Environmental Certification if it complies with the following conditions:

- 1) The building is not located in a natural protected area or at an archeological site;
- 2) It attends a rural population of less than 2,000 habitants. Also, it must comply with one of the following conditions:
  - 3) potable water with and without treatment;
  - 4) potable water by pump with and without treatment;
  - 5) Basic Unit of waterborne Sanitation;
  - 6) ecologic or compost basic unit sanitation;
  - 7) continuous composted basic unit of sanitation and 8) basic unit of sanitation in a dry ventilated hole (MA, 2013).

Peru has relied on cooperation alliances to build their technical capacities and to exchange experiences on sustainable building policy-making. Some of the most relevant cooperation initiatives currently in place are: the project, Development and Implementation of a Sustainable Housing Code in Peru, InterCLIMA – the learning platform for the promotion of a low-carbon development, the program, Development of Construction Measures and their Relation to Climate Change, and the design of the National Roadmap to Achieve Low-Carbon, Sustainable Buildings for Climate Change Mitigation, among others.

These initiatives prove that Peru seeks to integrate sustainable building into their national agenda and they are on the road to achieving it with support from international cooperation initiatives.

## Guatemala, Panama and Costa Rica

Guatemala presents great opportunities for the incorporation of the sustainable building sector in the national policy agenda. The country shares a vision with other Central American to incorporate sustainability concepts for national and regional development. This is reflected in the National Development Plan 2032, still in development process.

The country is in the initial stages of incorporating energy efficiency measures to buildings. The short-term plan is to incorporate an energy-saving lamp program for public lighting and residential use. Also, an energy efficiency pilot project of energy consuming equipment replacement is contemplated for public buildings. Furthermore, experience exchange programs have taken place with countries such as Mexico in order to carry out the Integral Training and Technical Assistance Program for Professional Development in Electric Energy Saving and Efficient Use.

Panama presents a remarkable economic growth trend due to the foreign investment promoted by the government. Panama is now going through the development process of their energy efficiency institutional structure, which incorporates the construction sector as one of the main strategy lines for the reduction of energy demand.

The Law 69 of 2012 sets the general guidelines for the efficient use of energy and establishes the development of the UREE Strategic Plan, which stipulates, among other actions, the development of building energy efficiency



technical standards and the creation of subsidies and financial mechanisms for their application, such as the UREE Mortgage Program (still in development process), which focuses on financing energy efficiency measures for low-income houses.

Of the three Central American countries, Costa Rica has most progress in the sustainable building sector. The technical norm RESET (Requirements for Sustainable Buildings in the Tropics) has been developed, and the tourism sector incorporates sustainability measures in hotel developments. The country has the ambitious goal of becoming carbon-neutral by 2021. To achieve this, they have integrated measures to reduce energy consumption and climate change adaptation incorporating sustainable building as support strategy.

### **General Recommendations**

Finally, future recommendations are established for policy-makers, national and sub national governments, and actors involved in the building and housing sector in Latin America.

- To explicitly position sustainable building in the public policy agenda, by developing a national strategy or plan that integrates and directs actions, with the objective of incentivizing sustainable building and have an adequate planning instrument to achieve it.
- To incorporate sustainable building concepts in strategic urban and city planning agendas.
- To integrate sustainable building policies and strategies in national transversal policies such as climate change, energy efficiency and social housing.
- Development of sustainable and energy efficient social housing projects under the NAMA and CDM schemes.
- Technical capacity building for the development of public policies and the implementation of sustainable building projects.
- Participation in Latin American and international sustainable building forums, where countries that have made more progress in sustainable building share experiences with countries that are still developing their institutional structure.
- Development of south-south cooperation initiatives to promote the exchange of resources, technology and knowledge among countries that are still developing their institutional structure.
- Development guidelines for the development of sustainable building public policies, instruments and programs.
- Development of sustainable building technical standards as in the case of Mexico and Chile and to promote the use of local and traditional sustainable building practices and integrate them and harmonize them with non-indigenous practices.

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## 10.1 Introduction

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Acerca de PNUMA, División de Tecnología, Industria y Economía

Creada en 1975, tres años después de que se creó el PNUMA, la División de Tecnología, Industria y Economía (DTIE) proporciona soluciones a los formuladores de políticas y ayuda a cambiar el ambiente de negocios, ofreciendo plataformas para el diálogo y la cooperación, opciones de políticas innovadoras, proyectos pilotos y mecanismos creativos de mercado.

DTIE juega un papel de liderazgo en tres de las seis prioridades estratégicas del PNUMA: cambio climático, sustancias nocivas y residuos peligrosos, y eficiencia de los recursos.

DTIE también está contribuyendo activamente a la Iniciativa de Economía Verde lanzada por el PNUMA en el 2008. El objetivo es trasladar las economías nacionales y del mundo a un nuevo camino, en el que los empleos y crecimiento de la producción son impulsados por una mayor inversión en los sectores verdes, y por un cambio de preferencias de los consumidores hacia los bienes y servicios ecológicos.

Asimismo, DTIE es responsable de cumplir con el mandato del PNUMA como organismo de ejecución del Fondo Multilateral del Protocolo de Montreal y juega un papel de ejecución en una serie de proyectos del PNUMA financiados por el Fondo Global para el Medio Ambiente

La Oficina Directora, con su base en París, coordina actividades a través de:

- > El Centro Internacional de Tecnología Ambiental – IETC (Osaka), promueve la recopilación y difusión de conocimientos sobre tecnologías ecológicamente racionales enfocadas a la gestión de residuos. El objetivo general es mejorar el conocimiento sobre la conversión de residuos en un recurso utilizable y reducir los impactos sobre la salud humana y el medio ambiente (tierra, agua y aire).
  - > Departamento de Producción y Consumo Sostenibles (París), el cual promueve patrones de consumo y producción sostenibles como una contribución al desarrollo humano a través de los mercados globales.
  - > Departamento de Químicos (Ginebra), el cual cataliza acciones globales para dar lugar al manejo seguro de químicos, así como al mejoramiento de la seguridad química en todas las regiones del mundo.
  - > Departamento de Energía (París y Nairobi), el cual fomenta políticas de energía y transporte a favor del desarrollo sustentable y alienta la inversión en la energía renovable y la eficiencia energética.
  - > Departamento de OzonAction (París), el cual apoya la desaparición de sustancias que provocan el adelgazamiento de la capa de ozono en los países en vías de desarrollo y en países con economías en transición, para así asegurar la implementación del Protocolo de Montreal.
  - > Departamento de Economía y Comercio (Ginebra), el cual ayuda a los países a integrar consideraciones ambientales en sus políticas económicas y de comercio. Así mismo, trabaja con el sector financiero para incorporar políticas de desarrollo sustentable. t Verde.

DTIE trabaja con muchos actores (otras agencias y programas de la ONU, organizaciones internacionales, gobiernos, organizaciones no gubernamentales, empresas, industria, medios de comunicación y el público) para crear conciencia, mejorar la transferencia de conocimientos e información, fomentar la cooperación tecnológica e implementar convenciones y acuerdos internacionales.

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