COPENHAGEN CENTRE ON ENERGY EFFICIENCY
SEforALL EE HUB

Building Efficiency Accelerator

ENERGY EFFICIENCY IN BUILDINGS

MAY 2019

Colombia

STATUS AND TRENDS

Located in the North-West of South America, the Republic of Colombia has a strategic position in the region through its exit to the Caribbean Sea and the Pacific Ocean. Characterised by diverse climate and a rich biodiversity, Colombia is the second largest country in the South American region by population, and fourth by area (Worldometers, 2018). Despite the severe impact of the 2008 economic crisis, Colombia fast recovered and now is the fourth-largest economy in the Latin American and Caribbean region, being one of the most attractive destinations for FDIs since 2011. The national GDP grew from 117 billion 2018 USD in 2004 to 280 billion in 2016, accompanied by the increase in CO_2 emissions of from 1.39 to 1.59 tCO_2/capita, corresponding to 77.7 Mton CO_2 total emissions in 2016 (Emissions Database for Global Atmospheric Research, 2017).

During the economic rise of Colombia, the energy sector played the central role representing 70% of total exports. Moreover, 10% of the country's GDP stems from the mining and energy sector (Nieves Zárate & Hernández Vidal, 2016). The country's total energy consumption in 2016 was 29.7 Mtoe, with significant energy losses, mainly due to technological obsolescence and lack of good operating practices in the country (Enerdata, 2018; Ministerio de Minas y Energía; Unidad de Planeación Minero Energética, 2016). With the energy intensity of 2 MJ/USD 2011 PPP GDP, the energy mix of Colombia is largely dominated by fossil fuels, as more than 78% of Colombian energy supply comes from coal, natural gas and oil (Figure 1) (The World Bank, 2018).

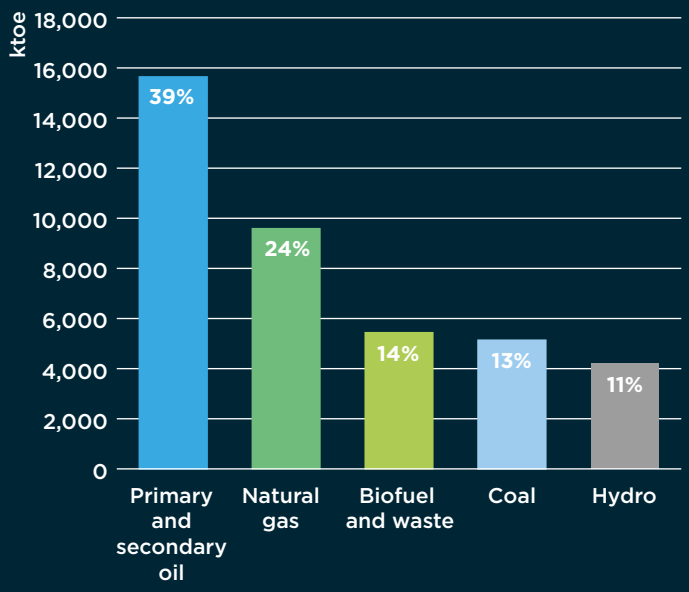
The main sources of electricity generation are hydro, natural gas and coal, with the installed supply capacity in 2015 at the level of 16.5 MW. Since the early 1990s there has been a steady increase in electricity demand, with simultaneous growth in electricity access, from 90% of the population in 1990 to 99% in 2016 (World Bank, 2018; Nieves Zárate & Hernández Vidal, 2016).

KEY INDICATORS

- Climate(s): mainly, tropical, equatorial
- Population: 48.7 million (77% urbanisation rate)
- GDP (at PPP 2016): USD 683 billion
- Primary energy intensity: 2 MJ / USD (2011 PPP)
- Emissions per capita: 1.8 tCO_2

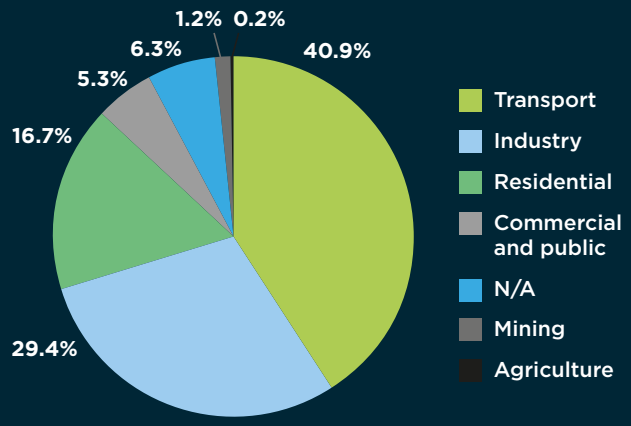
Source: World Bank, 2016

Figure 1. Total Primary Energy Supply (TPES) in 2016



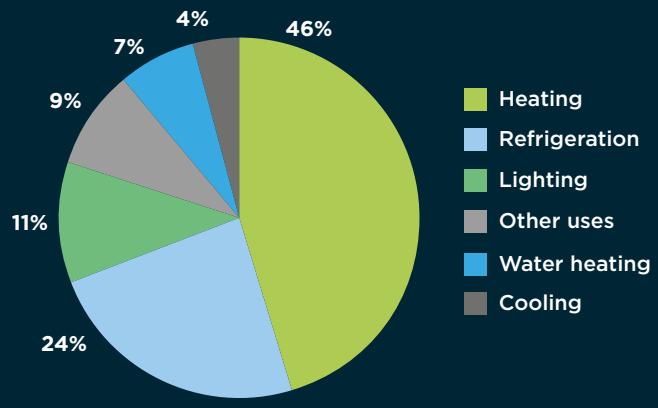
Source: International Energy Agency (2018)

Figure 2. Distribution of final energy consumption in 2015



Source: Ministerio de Minas y Energía; Unidad de Planeación Minero Energética (2016)

Figure 3. End-use of energy in the residential urban sector in 2015



Source: Ministerio de Minas y Energía; Unidad de Planeación Minero Energética (2016)

Transport has the largest share (more than 40%) in the country's final energy consumption, followed by industry (29%) and residential sector (16.7%) (Figure 2). Colombian electricity consumption is characterized by a similar sectoral distribution. (Nieves Zárate & Hernández Vidal, 2016).

In the residential sector, energy consumption is dominated by electricity and natural gas in urban areas and fuelwood in rural ones, with space heating being the most energy-consuming end-use (see Figure 3). The main reason for high energy intensity of the residential sector is the lack of maintenance and replacement of inefficient equipment, as well as inefficient operating practices. It has been estimated that adoption of minimum energy performance standards (MEPS) for the main appliances by 2020 will result in 73.3 TWh of the annual energy consumption in 2030 as opposed to 80.4 TWh without implementation of MEPS under the business as usual (BAU) scenario. (United for Efficiency, 2018).

Electricity in urban residential buildings is used primarily for refrigeration (39% of the total electricity consumption in 2015), television (20%) and lighting (10%). Currently 80% of domestic appliances in use are significantly (close to 50%) less efficient in comparison to new models available on the market (Nieves Zárate & Hernández Vidal, 2016; Minminas; EY, 2015).

During the first six months of 2018, 4.8 million m^2 of floor area were constructed, with the majority of being apartment buildings, followed by stand-alone houses, office and commercial buildings (Departamento Administrativo Nacional de Estadística, 2018). Due to the climate diversity of Colombia, the energy consumption of buildings varies largely amongst regions. Shopping centres demonstrate the highest energy consumption compared to other building types (see Table 1) (Ministerio de Vivienda, Ciudad y Territorio, 2015a).

Over 350 buildings across the country are certified under the LEED scheme, while there are more than 200 building projects under construction. These which will be categorised under the LEED scheme upon completion (Consejo Colombiano de Construcción Sostenible, 2018). Other certification schemes for sustainable and energy efficiency buildings include Referencial CASA Colombia. This has been built upon seven categories, which include water and energy efficiency, as well as material sustainability (ISMD Ingeniería sostenible, 2017). Moreover, through this certification it is possible to access credit instruments for both the construction company and the owners of the building (Monterrosa, 2018). In Colombia, 80 buildings were awarded the certification of

Table 1. Average energy consumption in kWh/m2 per year in different building types

kWh/m² per year	Cold climate	Temperate climate	Dry warm climate	Humid warm climate
Hotels	92	151	133	218
Hospitals	250	108	344	344
Offices	81	132	318	221
Shopping centres	404	188	188	232
Education	40	44	72	30
Households	46	49	39	50

Source: Ministerio de Vivienda. Ciudad y Territorio (2015a)

"Exceptional Sustainability" by Referencial CASA, while 75 the "Outstanding Sustainability" certificate, and 50 the "Sustainable" title (ISMD Ingeniería sostenible, 2017). Lastly, 3 building projects in Colombia are under the certification process under the EDGE scheme (Monterrosa, 2018).

INSTITUTIONAL FRAMEWORK

The institutional responsibility for designing and implementing policies for energy efficiency in buildings in Colombia lies with the *Ministerio de Minas y Energía* (MME – Ministry of Mining and Energy) and the *Ministerio de Vivienda. Ciudad y Territorio* (MVCT – Ministry of Housing. City and Territory). The agencies and institutions under the MME umbrella include:

- *Unidad de Planeación Minero-Energética* (UPME – Unity for mining and energy planning) – the authority in charge of planning national energy priorities with alignment to domestic energy demand. Moreover, the UPME prepares the National Energy Plans and the Plan for the Electricity Expansion.
- *Comisión de Regulación de Energía y Gas* (CREG – Commission for the Energy and Gas Regulation) – the commission created in accordance with the Law 143 of 1994. It aims at guaranteeing efficient and sufficient gas and electricity services in terms of quality and costs.
- *Comisión Intersectorial para el Uso Racional y Eficiente de la Energía y Fuentes No Convencionales de Energía* (CIURE – Intersectorial commission for rational and efficient use of energy and non-conventional sources of energy) – the commission created in 2003 to support the MME in policy coordination with other ministers, including the MVCT. The commission is presided by the MME and participates in design, implementation and monitoring of the *Programme for the Programa de Uso Racional y Eficiente de la Energía* (PROURE – Rational Use of Energy and the Use of Renewable Sources of Energy).

Since 2015, the MVCT is the official authority in charge of establishing and implementing the national guidelines for sustainable construction, including energy savings targets. The main institutional responsibility, however, is attributed to the MME and UPME, as according to the new institutional framework CIURE and the respective ministries (such as MVCT) are to participate in the policy planning (Ministerio de Minas y Energía; Unidad de Planeación Minero Energética, 2016).

In the early 1990s, the energy market was liberalised and since then companies in the electricity and hydrocarbon sectors have started to work together with national and local governments to supply energy, (Nieves Zárate & Hernández Vidal, 2016). Since 2016 Colombia has also started to work on policies to facilitate economic incentives for investments in energy efficiency, while designing legal measures for creating a legal framework, enabling the access to markets, encouraging competition equity and higher investments security (ibid).

The country, however, does not have a central authority responsible for energy efficiency and energy efficiency in buildings is often not considered among immediate policy priorities (Copenhagen Centre on Energy Efficiency, 2015).

POLICY FRAMEWORK

In the National Determined Contributions (NDCs), the Colombian government recognised energy as one of the priority areas, and set a conditional target of reducing country-wise emissions by 20% by 2030 in comparison with the business-as-usual (BAU) scenario. While it is mentioned in the NDCs that the BAU scenario already considers some efforts to increase energy efficiency in different sectors, energy efficiency is not explicitly mentioned among climate change mitigation measures (UNFCCC, 2018)

Law 697 (2001) is key for energy efficiency development in Colombia, as it declared that energy efficiency is of the public interest and established the PROURE (Nieves Zárate & Hernández Vidal, 2016).

The secondary regulation, which followed the Law 697 includes a number of decrees and national plans, such as the Presidential Decrees 3683 (2003), 2501 (2007) and the Resolution 180919 (2010). This supporting legislation targeted coordination of energy efficiency policies at the national level, creation of technical regulations, as well as promoting fiscal incentives and research for energy efficiency (ibid). The Resolution 180919 supported the Action Plan 2010-2015 by PROURE, which set the sectorial focus on residential buildings, industries and

transportation (Copenhagen Centre on Energy Efficiency, 2015).

Law 1715 (2014), also known as the Renewable Energies and Efficient Energy Management Law, established the role of efficient energy management and creation of a funding system for projects (Fondo de Energías no Convencionales y Eficiencia Energética – FENOGE), including the ones on energy efficiency (Nieves Zárate & Hernández Vidal, 2016).

Laws 697 and 1715 stipulated the requirement for energy efficiency standards, which targeted appliances and lighting respectively with the *Reglamento* Técnico de *Instalaciones Eléctricas* (RETIE – Technical Regulation on Electric Installations) and the *Reglamento* Técnico de *Iluminación y Alumbrado Público* (RETILAP – Technical Regulation on Lighting and Street Lighting) (Unidad de Planeación Minero Energética, 2018). Building sector was included under the technical Normative 6112, which covered environmental requirements, localization, energy and water consumption, air quality, waste management and construction materials for sustainable building design and construction (ICONTEC, 2016). Moreover, the Resolution 549 (2015) established that cities with more than 1.2 million inhabitants must implement measures for energy savings to promote sustainable buildings construction. The Resolution set the short-term goals for energy savings in respect to the type of buildings and created the framework for building labelling systems (Ministerio de Vivienda, Ciudad y Territorio, 2015b). However, this Regulation now is extended to all cities in Colombia, which must comply with the established goals of energy savings.

Currently, Colombia is implementing the Action Plan on Energy Efficiency 2017-2022, established under the Resolution 41286 (2016), which focuses on energy management and promotion of financial and technical services for implementation of projects (UPME, 2018). Energy efficiency measures for the residential sector presented in the Plan include: replacement of refrigerators with more energy efficiency ones, LED lighting, use of efficient materials in new construction, increased use of photovoltaics (PV) and installation of solar thermal energy (STE), as well as smart meters.

In addition to a growing legislative portfolio for energy efficiency of residential buildings, Colombia has designed policies to improve energy efficiency of non-residential buildings as well. The Resolution 549 (2015) by the MVCT designed guidelines to save energy for shopping centres, offices, hotels and educational institutions, with energy saving targets for the first and second year after the implementation of the Resolution. The targets for the first year are in the range of 10-15% for energy savings and for the second year – in the range of 15-45% in relation to the baseline energy consumption prior to implementation of the measures, as specified in the guidelines (Ministerio de Vivienda, Ciudad y Territorio, 2015b).

BARRIERS TO ENERGY EFFICIENCY IN BUILDINGS

- Limited coverage of building types by existing building standards. The Action Plan 2017-2022 urges to expand the scope of building standards to also include existing buildings, as the coverage of only new buildings limits the realisation of energy efficiency potential in the sector (Ministerio de Minas y Energía; Unidad de Planeación Minero Energética, 2016).
- Moreover, the PROURE highlights that the lack of awareness and knowledge on buildings energy standards by end users limits the uptake of energy efficient residential buildings and household appliances.
- The absence of a designated authority responsible for energy efficiency in the building sector creates difficulties in effective design and delivery of actions in this area.
- The institutions working with building energy efficiency have diverse priorities, which creates an uncoordinated institutional environment for policies and projects design and implementation (Ministerio de Minas y Energía; Unidad de Planeación Minero Energética, 2016).
- Energy efficiency in buildings is often not considered among the main policy priorities for the country, which results in a limited number of projects implemented in this area (as opposed to, for example, transport sector projects, which receive more significant allocation of resources) (Ministerio de Minas y Energía; Unidad de Planeación Minero Energética, 2016).
- Insufficient access to funds for energy efficiency projects and limited or non-existent involvement of the private sector reduce the potential for implementation and replication of efforts in the building sector.
- The ESCO market in Colombia is not yet well-developed mainly due to the lack of financial incentives and guarantees to secure credits (Copenhagen Centre on Energy Efficiency, 2015).
- As the promotion of efficient energy management was included in the national energy plan only recently, the skills and technologies needed for its effective implementation are still limited (Minminas; EY, 2015).
- Lack of educational and outreach campaigns to promote energy efficient appliances and energy saving practices in households limit the potential for energy efficiency improvements in residential buildings.

INTERNATIONAL SUPPORT

Colombia is well-positioned in the energy efficiency panorama of Latin America, as a member of the principal international and regional organizations for sustainable energy, such as the Latin American Energy Organisation (OLADE), the International Renewable Energy Agency (IRENA), and the Energy Charter Conference as an observer (Nieves Zárate & Hernández Vidal, 2016).

Several international projects on energy efficiency in buildings are taking place in Colombia. For instance, the project *Distritos Térmicos en Colombia* for district

heating was developed with the Ministerio de Ambiente y Desarrollo Sostenible (MADS – Ministry of Environment and Sustainable Development), the Swiss Agency for Economic Cooperation (SECO), the Presidential Agency for International Cooperation of Colombia (APC) and the Public Enterprises of Medellin (EPM) (Ministerio de Minas y Energía; Unidad de Planeación Minero Energética, 2016). This initiative has as an objective to implement district energy systems (DES) and improve energy efficiency of buildings. The pilot city for the initiative is Medellín with the focus on district cooling and the aim to reduce respective energy consumption by 25%. In case of a positive outcome, the project will be continued in Bogotá, Cali, Bucaramanga and Cartagena. This phase will also include district heating projects.

The InterAmerican Development Bank supported projects for water and energy efficiency for offices and companies in Colombia. This project executed 15 energy audits and designed solutions to improve energy efficiency in companies (US Aid, 2018).

The APC, supported by UPME and DNP, signed an agreement with Germany and Mexico to replicate the project implemented in Mexico by the Instituto del Fondo Nacional de Vivienda para los Trabajadores on the installation of green technologies in households, such as solar heaters. This project was based on the concept of triangular cooperation between the three countries and its objective for Colombia, as a recipient country, was to establish financing mechanisms for sustainable housing through green mortgages, based on the Mexican Infonavit's scheme (Ministerio de Minas y Energía; Unidad de Planeación Minero Energética, 2016). Moreover, this project created the basis to establish the Sustainable Housing Network for Latin America and the Caribbean (LAC Network), which aims at promoting sustainable residential buildings across the whole LAC region (Building and Social Housing Foundation, 2016).

The NAMA Facility in partnership with UPME, MADS and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), started a NAMA in 2017 for the domestic refrigeration sector. The project aims to ban hydrofluorocarbons and implement MEPS for the domestic refrigeration sector, as well as to provide incentives for low-income households to purchase energy efficient appliances (NAMA Facility, 2017).

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