The Industrialization Challenges of the LAC Region in Achieving the Sustainable Development Goal 9 and an Inclusive and Sustainable Industrial Development (ISID)

-Safeguarding the Environment-

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Table of Contents

1. Introduction

There are many challenges that the Latin American and Caribbean (LAC) region faces when it wants to achieve the United Nations' (UN) Sustainable Development Goal (SDG) No. 9 and an Inclusive and Sustainable Industrial Development (ISID), specially with the issue of safeguarding the environment. The promotion of ISID in developing countries and economies in transition has been entrusted to the United Nations Industrial Development Organization (UNIDO) by the United Nations. This responsibility has been recognized as the main UNIDO's mandate (United Nations General Assembly 2014).

Safeguarding the environment is a broad concept, from preserving natural resources to preventing climate change. In the field of sustainable energy, the provision of energy supply using renewable energy and the improvement of energy efficiency are essential to protect the environment from greenhouse gas (GHG) emissions. Furthermore, sustainable energy is considered as a precondition for economic growth, poverty reduction, and social equity, among others (UNIDO 2015a; UNDP 2015).

Inclusive and sustainable industrial development aims to boost industrialization of economies while creating shared prosperity and safeguarding the environment (UNIDO 2015b). Protecting the environment is an important concern to address in order to promote ISID in LAC countries. The main objective of this document is to describe the industrialization challenges within the LAC region to achieve the Sustainable Development Goal 9, taking into account the UNIDO's mandate in regard to ISID and environmental protection, but focused on renewable energy and industrial energy efficiency. The specific objectives are:

- Identify inter-linkages between SDG 9, ISID, and sustainable energy.
- Determine energy challenges relevant to sustainable industrial development in the LAC region.
- Provide challenges and barriers to renewable energy and industrial energy efficiency in the LAC region.

2. Economic and Social Issues of Latin America and the Caribbean

The Latin American and Caribbean (LAC) region comprises of 33 countries,[1] with a population of approximately 624.2 million, and many non-independent territories.[2] Spanish and Portuguese are the dominant languages, but more than 280 languages are spoken, including indigenous languages (CLACS n.d.). The majority of the population identifies itself as *mestizo* (mixed race) in many countries, but numerous distinct Afro- and indigenous groups can also be found. Consequently, the region could be considered as racial and ethnically diverse (World Bank 2003).

The LAC region encompasses countries with different stages of economic development. Based on the World Bank classification, there are nine high-income countries, twenty three middle-income countries, and one low-income country. In the middle-income category, six of the countries are classified as lower-middle-income countries and the remainder as upper-middle-income countries (World Bank 2015).[3] The region presents dissimilar economic realities, thus suggesting that distinct approaches should be followed (UNIDO 2013).

The economy of Latin America and the Caribbean has had a changing performance over the last years. Considering data between 2006 and 2014, the annual growth rate of the gross domestic product (GDP) per capita reached a peak of 5% in 2010. However, this rate declined to 0.1% in 2014, indicating that the economy of the region, as a whole, stagnated. Moreover, Mexico and Colombia, two of the five largest economies of the region, experienced an increase in GDP per capita of 1% and 3.2% in 2014, respectively (ECLAC 2015a).

[1] A list of LAC countries can be seen at: http://www.cepal.org/en/estados-miembros

[2] The population is based on data of each LAC country. These data can be found at: http://data.worldbank.org/

[3] The World Bank classifies countries according to Gross National Income (GNI) per capita. By 2014, the classification is: low-income, US$1,045 or less; lower-middle-income, from US$1,046 to US$4,125; upper-middle-income, from US$4,126 to US$12,735; and high income, more than US$12,735. See more [online] at: https://datahelpdesk.worldbank.org/knowledgebase/articles/378834-how-does-the-world-bank-classify-countries

3. Inter-Linkages between Sustainable Development Goal 9, Inclusive and Sustainable Industrial Development, and Sustainable Energy

3.1. Sustainable Development Goal 9

The member countries of the United Nations agreed in 2000 to halve extreme poverty and to reduce other deprivations in the developing world by 2015. The Millennium Development Goals (MDGs) were born from this agreement. Because the time frame finished, a new agenda has been defined, giving birth to 17 universal goals, i.e. the Sustainable Development Goals, to be achieved by 2030 (ECLAC 2015b).

The Sustainable Development Goal (SDG) 9, on building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation, encourages the development of the industry sector, but following a sustainable pathway (United Nations General Assembly 2015). The aim of the SDG 9 is three-fold; inclusive and sustainable industrial development (ISID) is embedded into it.

The SDG 9 recognizes the energy challenges of a sustainable industrialization. The target 9.4, one out of eight targets of the SDG 9, determines to increment resource-use efficiency and to scale up the implementation of clean technologies in the industry sector. Under a global approach, the SDG 9 is interrelated to the SDG 7 on promoting sustainable energy (United Nations General Assembly 2015; UNIDO 2015c).

3.2. Inclusive and Sustainable Industrial Development

The mission of inclusive and sustainable industrial development is aimed to enhance economic, social, and environmental aspects. It involves:

- Achieve a higher level of industrial development
- Share prosperity among people
- Ensure a sustainable environmental framework
- Maximize the impact by leveraging development actors into ISID (UNIDO 2014).

No country has ever reached a high level of economic and social development without industrialization (UNIDO 2014). The provision of sustainable energy and a higher

efficiency in the end-use energy demand are essential to support a sustainable industrial development (UNIDO 2015a). In that sense, it is kept away the traditional approach to use conventional fossil fuels to meet the energy demand. Renewable energy and energy efficiency play an important role to environmental protection by reducing energy-related emissions (UNIDO 2015b).

4. Energy Challenges of Sustainable Industrialization

Industrialization and economic growth drive energy use, among other drivers, in many developing countries (UNDP 2000). Balza, Espinasa and Serebrisky (2015) state that the primary energy supply in the LAC region will grow at an average annual rate of 2.2% over the next years. In the power sector, it is estimated that the electricity demand of the region[4] will reach approximately 1,559 TWh by 2035, a growth of 78.2% compared to 2010, and Brazil will account for more than half of that demand (IEA 2012).[5] Therefore, new electric power infrastructures will be needed to meet that future demand. The main energy source -either renewable energy or fossil fuels- will depend on countries of the region to agree on emission reduction targets (Balza, Espinasa & Serebrisky 2015). Security of electricity supply in the LAC region presents an enormous challenge.

Access to modern energy serves as a basis for social and economic development in developing countries and economies in transition (UNDP 2015; UNIDO 2015a). In the LAC region[6], people without access to electricity are estimated to be a 6% of the population. In addition, 14% of the population still relies in biomass for cooking (IEA 2012). Achieving the sustainable development goals will depend, to some extent, on overcoming the challenge to increase the provision of clean and modern energy services (UNDP 2015).

4.1. Renewable Energy

In 2014, the Latin American and Caribbean countries had an installed power generation capacity of 352 GW. The renewable energy sources accounted for 56% of the capacity

[4] The estimate of the "World Energy Outlook 2012" report does not include Mexico in this group of countries.
[5] The values are based on the central scenario of the "World Energy Outlook 2012" of the International Energy Agency (IEA), i.e. the New Policies Scenario.
[6] Not including Mexico.

mentioned (The Climatescope 2015).[7] The power generation matrix in some LAC sub-regions presented dissimilar compositions. For instance, the electric power sector of Central America, totally composed by middle-income countries, had an installed capacity of approximately 13.7 GW of which 59.1% was based on renewable energy (ECLAC 2015c).[8] However, Caribbean countries had only 12% of installed renewable capacity (The Climatescope 2015).[9]

The LAC region has used its vast amount of water resources and biomass potential to generate electricity (The Climatescope 2015). For example, the Itaipu hydroelectric power plant, which provides electricity to Brazil and Paraguay, ranks as the second largest hydropower plant in the world (Itaipu Binacional 2015). Hydropower provides between 50-60% of the electricity supply in the region. This imposes a heavy reliance on one source of electricity generation. Severe droughts could reduce the availability of electricity, hence, causing blackouts. A diversification of the generation matrix, using renewables such as wind and solar, might hedge the risk of hydropower shortfalls and increase resilience to climate change (REN21 2015). The implementation of energy policies by LAC governments has enabled the addition of non-conventional renewable energy to the generation matrix (CAF 2013).

The most effective policy mechanism in the LAC region to scale up the deployment of renewable energy generation systems is reverse auctions. For instance, countries such as Brazil, Chile, Jamaica, Panama, and Uruguay have used reverse auctions to increase renewables (The Climatescope 2015). Additionally, feed-in tariffs have been used by some LAC countries as well (IRENA 2015a). For example, Honduras, a relatively small country, supported the installation of utility-scale photovoltaic power plants in 2014, up to a cumulative capacity of 300 MW, through a feed-in tariff incentive (The Climatescope 2015).

Other renewable energy support policies include tax incentives, quotas, net metering, fiscal incentives, and public financing.[10] For instance, sixteen LAC countries have already implemented net metering at national, state or provincial level, including the four most

[7] The reviewed data did not include Antigua and Barbuda, Cuba, Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia, and Saint Vincent and the Grenadines.
[8] In this document, renewable energy includes large hydropower plants.
[9] The data includes The Bahamas, Barbados, Dominican Republic, Guyana, Haiti, Jamaica, Suriname, and Trinidad and Tobago.
[10] The list is not exhaustive.

populous countries of the region, which are Brazil, Mexico, Colombia, and Argentina (REN21 2015).[11] Under a net metering scheme, customers with renewable power plants can feed their electricity surplus into the grid (see Figure 1). If imported electricity from the grid by a customer is higher than exported electricity; then, the net electricity consumption has to be paid. On the other hand, if imported electricity is less than exported electricity; then, the customer is offset by an energy credit or a payment (Dufo & Bernal 2015).

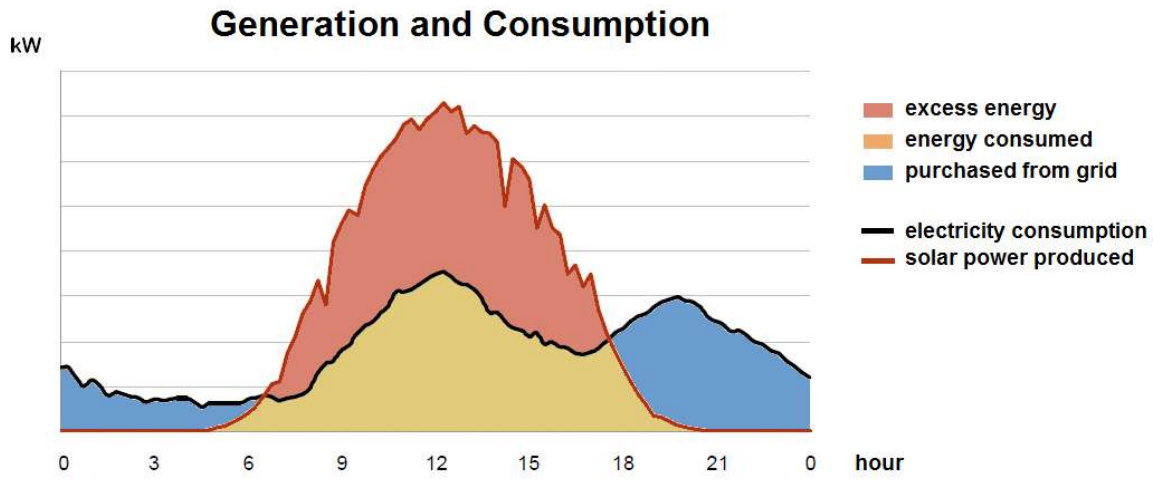

Figure 1. Customer with a photovoltaic system delivering electricity excess to the grid. Source: adapted from Heliopower (2015).

Industries, as electric utility customers, producing their own electricity from renewables on-site play also a role. The traditional approach of adding centralized power plants to meet the increasing electricity demand, although still is very important, is not longer the only way. The benefits of sustainable on-site generation are many, from reducing energy costs of industries to promoting local jobs. Nonetheless, some barriers are still needed to be overcome, such as lack of regulatory policies for the sale of excess energy and opposition from electric utilities (UNIDO 2015d).

The challenges are not only in the supply side, but also in the end-use side. An analysis of the International Renewable Energy Agency (IRENA) shows that increasing the share of renewable energy in the total final energy consumption to 36% by 2030 would maintain the global temperature rise under 2°C. However, the same analysis indicates that end-use

[11] No data was available for Antigua and Barbuda, The Bahamas, Bolivia, Cuba, Dominica, Saint Kitts and Nevis, Suriname, and Venezuela.

energy efficiency measures are also needed (IRENA 2015b). The next section gives an overview of the energy efficiency challenges in the industry sector.

4.2. Industrial Energy Efficiency

Energy efficiency in industry is considered as a way to decouple economic growth from carbon emissions (UNIDO 2009). The industry sector employs 28% of global energy use and produces 32% of worldwide energy-related carbon dioxide (CO_2) emissions, including electricity-related emissions (IEA 2012).[12] Based on an Inter-American Development Bank (IDB) database from 2013, the industry sector consumes approximately 32% of the LAC region final energy and 44% of the electricity end-use.[13] Energy-intensive industries, such as cement, iron and steel, chemicals, and pulp and paper, as well as agro industry and mining, are found in the region (IEA 2015).

Considerable energy efficiency potential is still untapped worldwide (UNIDO 2009), and the LAC region is not an exception (IEA 2015). In many countries of the Organization for Economic Co-operation and Development (OECD),[14] the energy efficiency potential by using efficient technologies has been already exploited in large energy-intensive companies, but some improvements still can be carried out through, for instance, better energy management practices. In non-OECD countries, energy-intensive industries with modern facilities usually use efficient technologies; however, older infrastructure still has energy efficiency improvements to be performed (IEA 2012). The implementation of energy management standards such as ISO 50001 could be promoted in large energy-intensive industries of LAC countries (IEA 2015).

The ISO 50001 energy management standard has been adapted by many countries with the aim to reduce energy consumption and its associated costs in private and public organizations (ISO 2011; ISO 2014). Globally, many organizations have implemented certified energy management systems under ISO 50001. Most certifications are found in Germany with 3,402 and the United Kingdom with 376 (ISO 2014). Figure 2 shows the sites with ISO 50001 certificates in the Latin American and Caribbean region. It is

[12] Data from 2010

[13] The reviewed data did not include Antigua and Barbuda, Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia, and Saint Vincent and the Grenadines. See more [online] at: http://www.iadb.org/en/topics/energy/energy-database/energy-database,19144.html

[14] Chile and Mexico are the only OECD member countries from the LAC region.

observed that Brazil has the lead in terms of sites with a certification, followed by Chile and Mexico.

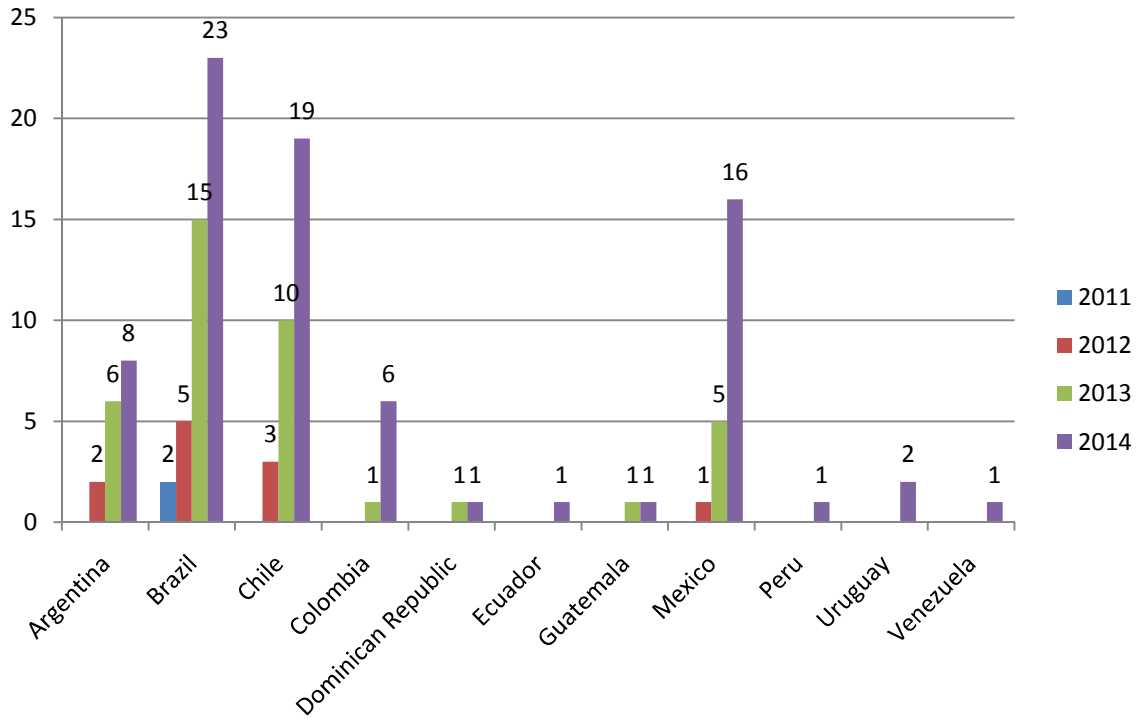

Figure 2. Number of sites with ISO 50001 certification in Latin America and the Caribbean per year. Source: ISO (2014).

The energy efficiency challenges are not only present in energy-intensive industries, but also in non-energy-intensive industries. In OECD countries, non-energy-intensive industries still have energy efficiency potential to be harnessed (IEA 2012). In developing countries, there is still substantial potential in industries as well (UNIDO 2011). Some general barriers to industrial energy efficiency improvements are that companies have sometimes lack of awareness and practical knowledge, request short payback periods for investments, and consider that energy efficiency activities might affect productivity (IEA 2012).

The LAC region faces common barriers to energy efficiency improvements in different sectors. These barriers include: energy prices that do not reflect the real cost due to subsidies (e.g. the annual energy subsidy in LAC countries was estimated at 1.8% of GDP between 2011 and 2013 (IMF 2015)), inability of institutions to continuous decision-making, ministries have reduced capacity of planning and coordination, energy service

companies (ESCOs) lack of enough incentives, and suitable forms of financing are non-existent. In the industry sector, the LAC region also deals with unavailability of energy efficient technologies (IEA 2015). One of the reasons is that the market of many countries is not large enough to maintain those technologies readily on hand (CAF 2013). Governments could provide a strong institutional framework under which energy efficiency actions can be successfully carried out (IEA 2015).

Small and medium-sized enterprises (SMEs) also have energy efficiency barriers to overcome. In developing countries, SMEs bear the largest difficulties to implement energy efficiency actions (UNIDO 2011). Their barriers have to be addressed differently, since the energy use of these firms might vary compared to others. Those barriers include limited expertise and capacity to identify energy efficiency measures, distrust of energy efficiency technical information given, and lack of financial instruments to reduce the risk of investments. Governments could develop tailored policies for SMEs to promote energy efficiency (IEA 2015; ECLAC 2014).

5. Conclusions

The Latin American and Caribbean region presents many challenges to achieve an inclusive and sustainable industrial development in regard to safeguarding the environment. The Sustainable Development Goal 9 has ISID as an integral part of its aims, and ISID is supported by sustainable energy. It follows that it is crucial for ISID to scale up the use of renewable energy, improve industrial energy efficiency, and increase access to modern energy services.

Energy demand is driven by economic growth and industrialization. However, decoupling economic growth from energy demand and making industries more sustainable are encouraged to protect the environment. Electricity supply with renewable energy and industrial energy efficiency improvements are means to decrease the use of conventional fossil fuels, thus reducing associated GHG emissions.

The energy demand of the LAC region will increase during the forthcoming years. Security of supply in the power sector with renewable energy is considered a major challenge. Issues such as increasing energy demand, resilience to climate change, and energy policies will guide the future use of renewables in the LAC region. Additionally, decreasing

the population without access to modern energy services to promote economic development is unavoidable.

On the other side, the industry sector accounts for a large portion of the final energy consumption. Therefore, industrial energy efficiency is considered as key to achieving sustainable industrialization. The challenge is to overcome institutional, market, and behavioral barriers that hamper energy efficiency actions in order to harness the untapped energy efficiency potential of the region. Governments might promote energy efficiency measures considering energy intensity and size of industries.

6. Recommendations

From the document, it is recommended the involvement of governments to promote sustainable energy, considering its importance to reduce GHG emissions. Governments of the LAC region should design and implement policies to increase renewable energy and improve industrial energy efficiency, taking into account the capabilities of each country, to support a sustainable industrialization.

Additionally, an international or regional collaboration is recommended to play a role to overcome those barriers related to, for instance, availability of information or capacity building. For individual country cases, a triangular cooperation might be the approach to follow due to its potential to establish collaborations between countries of the LAC region in conjunction with international organizations. For some sub-regional cases, countries could focus on setting partnerships, where they are not placed yet, in order to provide a benchmarking platform or obtain economies of scale.

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