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TECHNICAL NOTE NO.4
Towards a low-emission natural gas industry in Latin America and the Caribbean

Contents

Introduction

Reducing greenhouse gas (GHG) emissions from the energy sector is an important objective in the energy transition process in Latin America and the Caribbean (LAC). In this context, the participation of natural gas (NG) in the energy matrix becomes even more relevant, both for industrial, commercial or domestic uses, as well as for the generation of electrical energy. In the latter area, energy plays a fundamental role as a substitute for coal and oil-based fuels.

It is noteworthy that in the last 20 years the use of NG for electricity generation has grown significantly and steadily, thus contributing to the reduction of GHG emissions from the sector (OLADE, 2024). This growth in the share of NG is due to the substitution of other hydrocarbons and coal, as well as its selection as a fuel when an expansion of thermoelectric generation capacity is carried out.

Likewise, technological advances make it possible to reduce GHG emissions in the production and transport chain.

Our region has competitive advantages to move towards an increase in the share of gas in the energy matrix, to the detriment of other fossil fuels. Among the advantages are the availability of the resource, the infrastructures for transport via pipelines (mainly in the southern cone of the continent) and the infrastructures deployed for liquefaction and subsequent gasification of the same.

Given the important role to play as an energy transition, within the framework of a just transition that our countries are carrying out, it is that this challenge must be advanced throughout the industry's value chain.

The industry can be divided into three sections: *upstream, midstream and downstream*. These sections encompass the processes from extraction to the final use of energy. And it is in that sense that this Technical Note will propose an overview of the sector, the challenges faced in moving towards the decarbonization of the industry, the possible future scenarios and their conclusions.

The natural gas sector in LAC

Sections of activity in the sector.

The NG industry is composed of various processes and actors ranging from the extraction of the resource to its end use. In general terms, these activities can be subdivided into three sections: *upstream, midstream and downstream.*

Within the framework of the *upstream* we find the extraction process either *onshore* or*offshore* and everything necessary to reach the transport phase, including: particle filtration, sweetening, dehydration, etc.

Within the framework of the *midstream* we find the processes of transport, liquefaction and storage. At this point we stop talking about NG and go on to talk about LNG (Liquefied Natural Gas).

In the *downstream* section we find the processes of maritime transport, regasification and end uses.

Production of natural gas

LAC countries do not have a homogeneous situation with respect to the production, transport and infrastructure of natural gas, likewise the region does not represent a major player in the global NG market. However, investments are currently being made in several countries in the region both in extraction, transport infrastructure and liquefaction – regasification infrastructure.

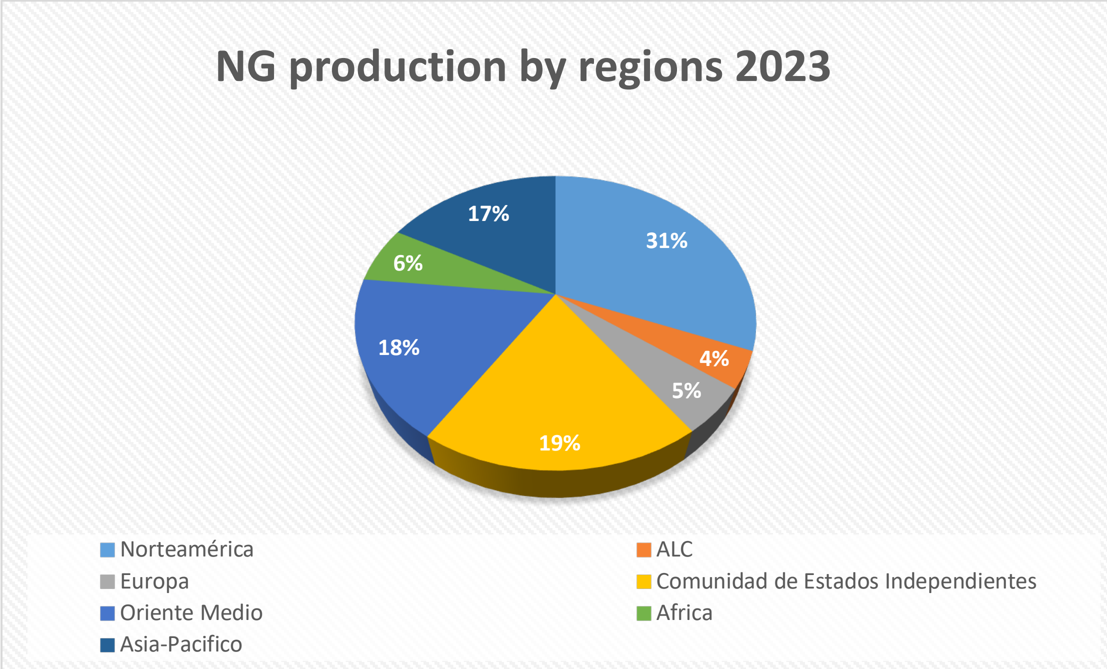
LAC represents 4% of global gas production, (Energy Institute, 2024) being the region with the lowest share of gas production, as shown in Table No.1 and visualized in Graph No. 1 below.

Table No. 1

NG production by regions 2023	
North America	31.1%
LAC	4.0%
Europe	5.0%
Commonwealth of Independent States	19.1%
Middle East	17.6%
Africa	6.2%
Asia-Pacific	17.0%

Source: own elaboration based on information from the Energy Institute. Statistical Review of World Energy(Energy Institute, 2024).

GRAPH No. 1



Source: own elaboration based on information from the Energy Institute. Statistical Review of World Energy(Energy Institute, 2024).

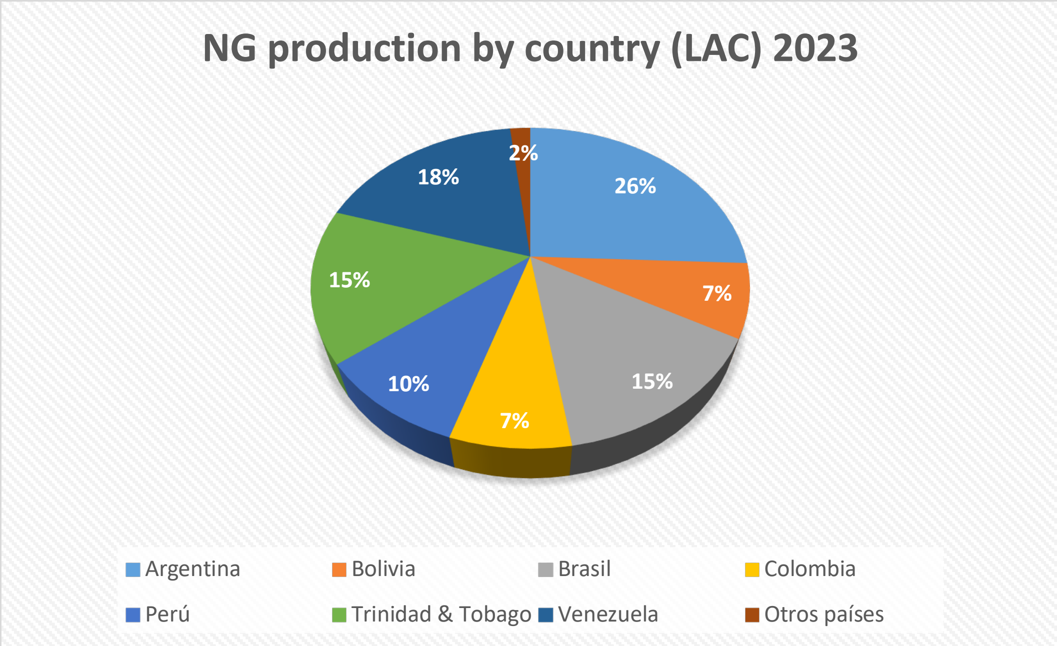
As can be seen in Table No. 2, in LAC five countries are responsible for 84% of total production, these are: Argentina, Venezuela, Trinidad and Tobago, Brazil and Peru.

Table No. 2

NG production by country (LAC) 2023	
Argentina	41.6
Venezuela	29.7
Trinidad & Tobago	25.0
Brazil	23.4
Peru	15.4
Colombia	12.1
Bolivia	11.9
Other countries	2.9
Total (Trillion cubic meters)	162.0

Table No. 2 Source: own elaboration based on information from the Energy Institute. Statistical Review of World Energy(Energy Institute, 2024).

GRAPH No. 2



Source: own elaboration based on information from the Energy Institute. Statistical Review of World Energy(Energy Institute, 2024).

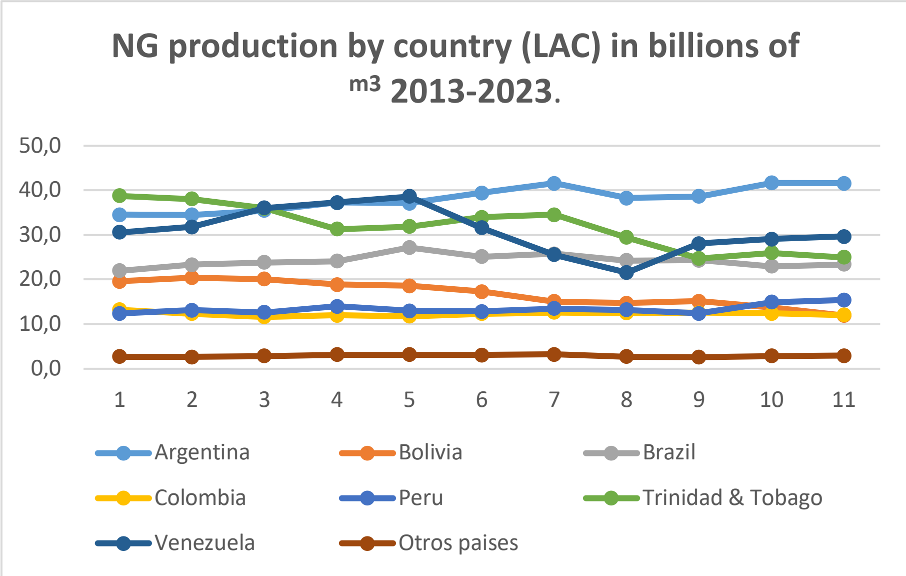
Likewise, it is interesting to see the evolution of NG production in the LAC countries in the period 2013-2023, as can be seen from Table No. 3 and GRAPH No.3 is quite heterogeneous, with countries that significantly increase their production while others significantly reduce it.

Table No. 3

NG production by country (LAC) Period 2013-2023. (Trillion cubic meters)									
Year	Argentina	Bolivia	Brazil	Colombia	Peru	Trinidad & Tobago	Venezuela	Other countries	Total
2013	**34.6**	**19.6**	**21.9**	**13.2**	**12.4**	**38.7**	**30.6**	**2.7**	**173.8**
2014	34.5	20.4	23.3	12.3	13.1	38.1	31.8	2.6	**176.2**
2015	35.5	20.1	23.8	11.6	12.7	36.0	36.1	2.9	**178.6**
2016	37.3	18.9	24.1	12.0	14.0	31.3	37.2	3.1	**178.0**
2017	37.1	18.6	27.2	11.8	13.0	31.9	38.6	3.1	**181.3**
2018	39.4	17.3	25.2	12.4	12.8	34.0	31.6	3.1	**175.8**
2019	41.6	15.1	25.7	12.6	13.5	34.6	25.6	3.3	**172.0**
2020	38.3	14.7	24.2	12.5	13.2	29.5	21.6	2.7	**156.6**
2021	38.6	15.1	24.3	12.6	12.4	24.7	28.1	2.6	**158.5**
2022	41.7	13.7	23.0	12.4	15.0	26.0	29.1	2.8	**163.6**
2023	**41.6**	**11.9**	**23.4**	**12.1**	**15.4**	**25.0**	**29.7**	**2.9**	**162.0**

Source: own elaboration based on information from the Energy Institute. Statistical Review of World Energy(Energy Institute, 2024).

GRAPH No. 3



Source: own elaboration based on information from the Energy Institute. Statistical Review of World Energy(Energy Institute, 2024).

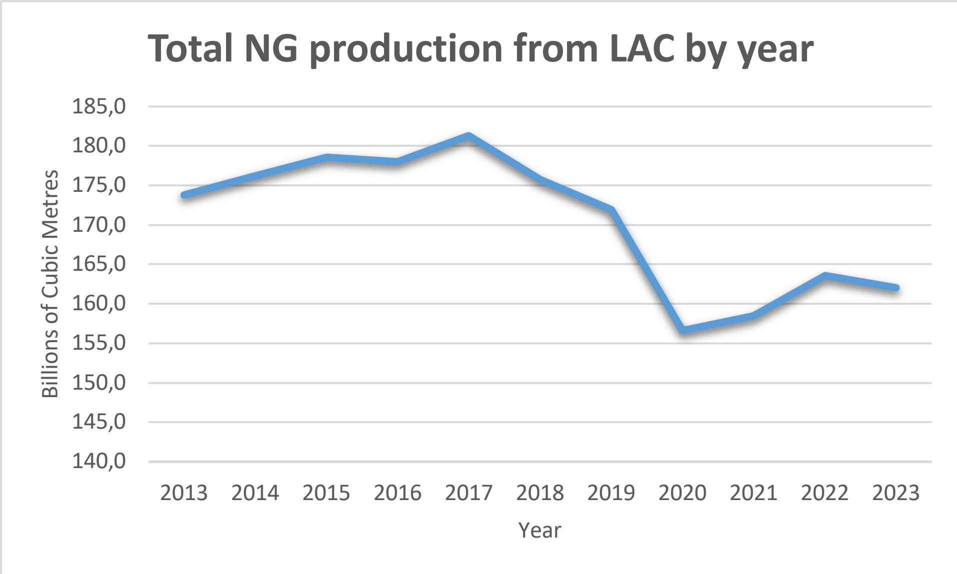
LAC shows a downward trend in production in the period 2013-2023 as seen in Table and Graph No. 4

Table No. 4

Total LAC NG production per year in trillion m3	
Year	Production
2013	**173.8**
2014	**176.2**
2015	**178.6**
2016	**178.0**
2017	**181.3**
2018	**175.8**
2019	**172.0**
2020	**156.6**
2021	**158.5**
2022	**163.6**
2023	**162.0**

Source: own elaboration based on information from the Energy Institute. Statistical Review of World Energy(Energy Institute, 2024).

GRAPH No. 4



Source: own elaboration based on information from the Energy Institute. Statistical Review of World Energy(Energy Institute, 2024).

Proven reserves

This section presents *onshore, offshore* and total LAC production. Venezuela accounts for 68% of the reserves, followed by Brazil with 6.42% and Argentina with 5.5%, while Guyana ranks fourth with 4.58%.

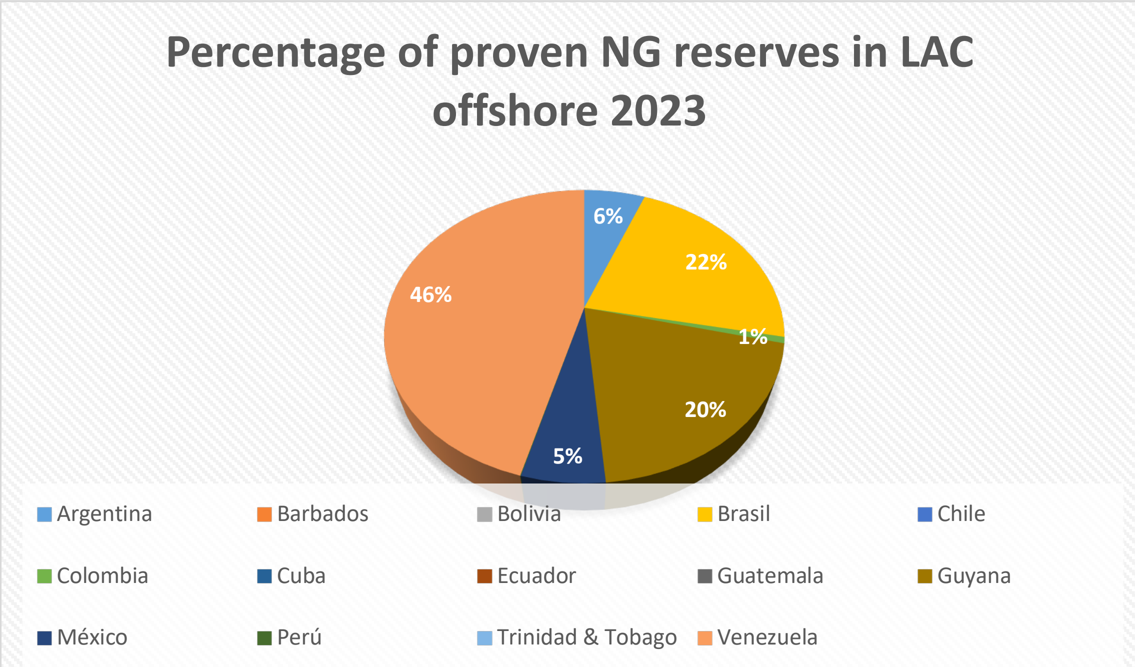
In Table No. 5 and graphs 5, 6 and 7, the *onshore, offshore* and total GN LAC proven reserves are presented.

Table No. 5

Country	Expressed in 10^9 m³		
	Proven offshore	Proven onshore	Proven Total
Argentina	111.11	331.36	442.47
Barbados	0.00	0.09	0.09
Bolivia	0.00	253.44	253.44
Brazil	416.51	100.57	517.08
Chile	0.00	8.15	8.15
Colombia	12.90	54.29	67.19
Cuba	0.00	68.99	68.99
Ecuador	0.00	3.76	3.76
Guatemala	0.00	3.35	3.35
Guyana	369.00	0.00	369.00
Mexico	105.23	207.07	312.30
Peru	0.86	236.80	237.66
Trinidad & Tobago	0.00	288.83	288.83
Venezuela	856.32	4619.85	5476.17

Source: own elaboration based on information from sieLAC-OLADE (SieLAC OLADE, 2024).

GRAPH No. 5

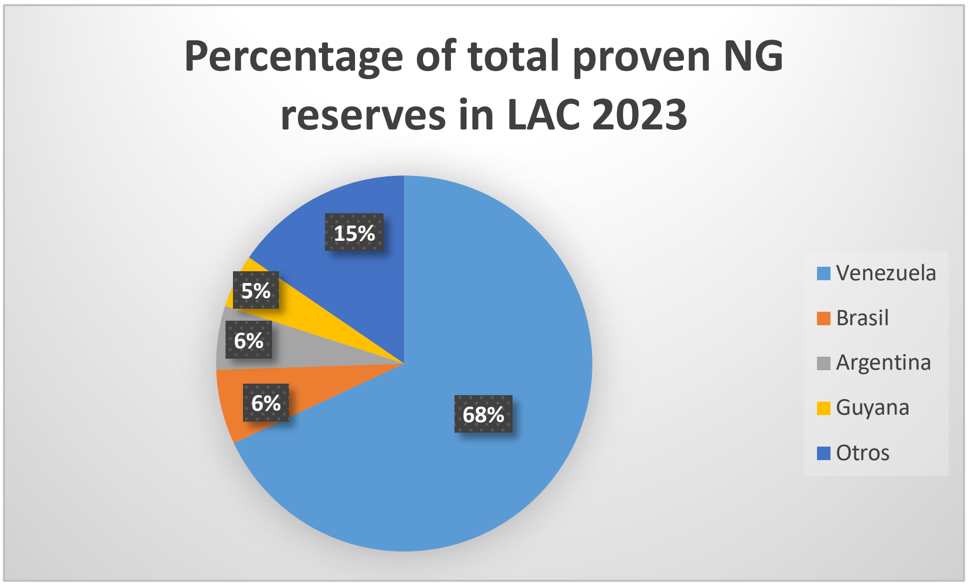


Source: own elaboration based on information from SIELAC- OLADE (SieLAC OLADE, 2024).

GRAPH No. 6

Source: own elaboration based on information from SIELAC- OLADE (SieLAC OLADE, 2024).

GRAPH No. 7



Source: own elaboration based on information from SIELAC- OLADE (SieLAC OLADE, 2024).

Infrastructure

At the level of gas infrastructure, it is interesting to take into account the regional infrastructure of both gas pipelines and LNG storage, as well as the plants associated with liquefaction and gasification.

The transport capacity through gas pipelines in LAC is 3.5 trillion m^3/day, where Argentina with 41% of the transport capacity is the country with the highest transport capacity, followed by Colombia (21%), Mexico (20%) and Brazil (8%).

In terms of liquefaction, gasification and storage processes, LAC already has operational infrastructures. In terms of liquefaction, Trinidad and Tobago (67%) and Peru (33%) are the countries that carry out this process with a capacity of 1.6 million m^3 while in terms of regasification, the capacity is 3.7 million m^3 (International Association of LNG Importers (GIIGNL), 2023) as shown in Table No.6.

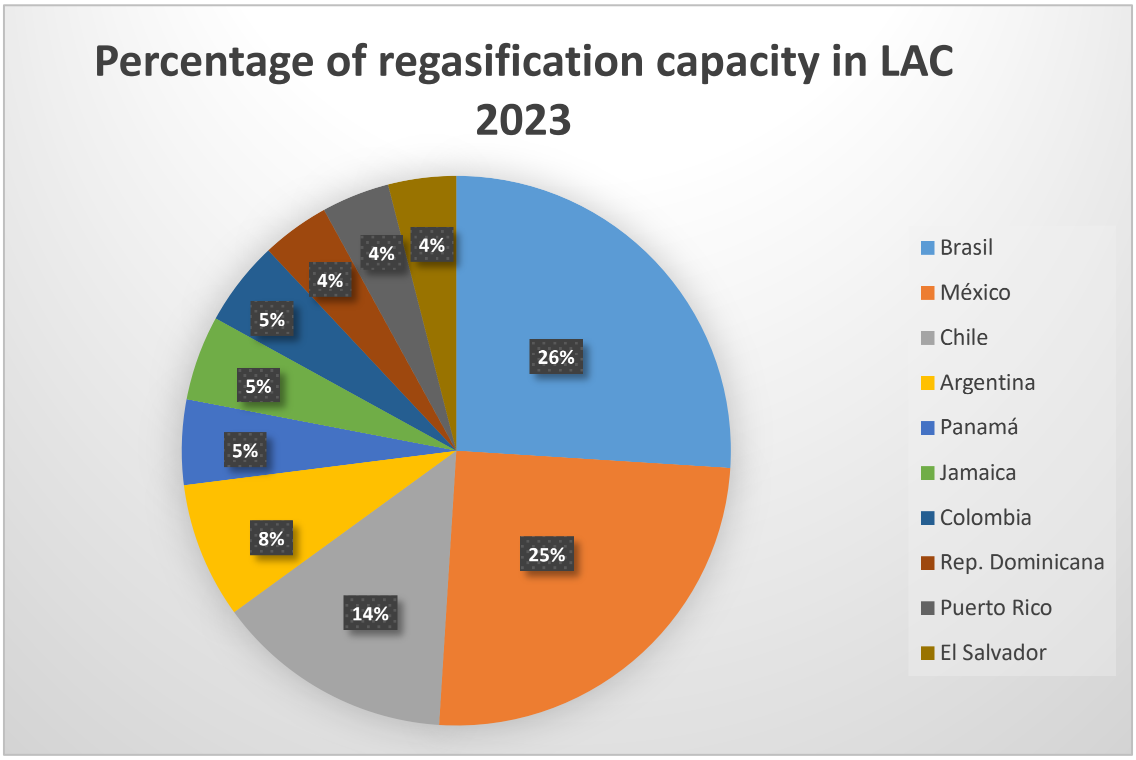
Table No. 6

Percentage of regasification capacity in LAC	
Brazil	26%
Mexico	25%
Chile	14%
Argentina	8%
Panama	5%
Jamaica	5%
Colombia	5%
Dominican Rep.	4%
Puerto Rico	4%

El Salvador	4%

Source: own elaboration based on GIIGNL information (International Association of LNG Importers (GIIGNL), 2023).

GRAPH No. 8



Source: own elaboration based on GIIGNL information (International Association of LNG Importers (GIIGNL), 2023).

In LAC, 89 gas pipelines are currently operating, of which 73 meet national demand while the remaining 16 are binational in nature in order to export and import energy.

Mexico leads in the number of national gas pipelines in the region, with a total of 24. It is followed by Argentina (13), Brazil (13), Bolivia (7), Venezuela (7), Trinidad and Tobago (5), Colombia (2), Ecuador (1) and Peru (1) (OLADE, 2024).

In terms of kilometers of gas pipelines, Argentina and Mexico each have more than 17,000 kilometers of gas pipelines. They are followed by Brazil, Colombia, and Venezuela, with lengths ranging from 4,000 to 9,000 kilometers. With less than 3,000 kilometers of gas pipelines, there are Bolivia, Chile, Peru, Trinidad and Tobago and Ecuador (OLADE, 2024)

Main Challenges of Moving Towards a Low-Emission LAC Natural Gas Industry

The use of NG and LNG as energy sources allows progress to be made in the decarbonisation of large sectors of the economy, in an orderly manner and within the framework of a fair energy transition. This occurs through the substitution in the energy consumption matrix of energy with higher CO_2 eq. emissions such as those derived from oil and coal, whether for electricity generation, industrial uses and residential uses.

However, the industry also has technological and management challenges for a decrease in CO_2 eq emissions in its production processes.

The reduction of the carbon footprint presents challenges such as *flaring* (burning of a part of the gas that is not used in the process or transported), *venting* (release of the gas outside the system) and *boil-offs* (gradual evaporation process by heating the LNG), which can become competitive advantages at a global level. The former are linked to the burning of fuel for the operation, the latter are linked to the release of gas into the atmosphere in a controlled manner somewhere in the production process. We must also take into account those emissions in which uncontrolled leaks occur in any of the phases of the production process, the latter is also called fugitive emissions.

Among the main technological lines in which the industry is focusing for the purposes of reducing emissions are those of:

- Carbon capture and storage
- Biomethane
- Incorporation of green hydrogen

It is also important to note that the industry must continue with the process of reducing and eliminating methane emissions during the different phases of the process.

It is important to highlight that all the efforts made for the integration of infrastructures will contribute to the decrease of the carbon footprint of the sector as well as to the decrease of emissions of end users, with emphasis on the industry and the energy sector, as well as in a virtuous circle of economic energy integration of LAC.

Some decarbonization scenarios for the sector

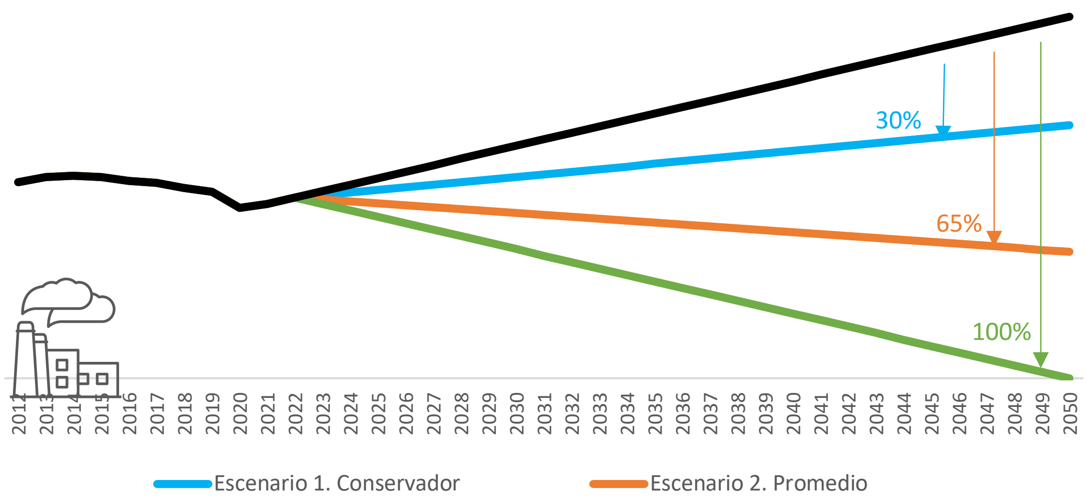
The gas sector in LAC is heterogeneous and diverse, so this section presents a group of technologies and three scenarios for the decarbonization of the industry by 2050. For this chapter, the results set out in the document "Certification of Low Emission Natural Gas in Latin America and the Caribbean. Ambition and investment requirements" will be followed(Anaya, 2024).

With regard to the scenarios, three types of objectives are proposed:

- Scenario 1. 30% reduction in GHG emissions compared to the BAU by 2050
- Scenario 2. 65% reduction in GHG emissions compared to BAU by 2050
- Scenario 3. 100% reduction in GHG emissions.

Scenario 1, although it proposes a reduction in emissions with respect to the BAU in 2050, would be higher in absolute terms than the current ones, while in scenario 2 they would be lower in absolute terms than the current ones. In reference to scenario 3, 0 emissions are proposed.

Figure No. 1:



Source: Low Emission Natural Gas Certification in Latin America and the Caribbean. Ambition and investment requirements (Anaya, 2024).

For the reduction of emissions, it should be noted that the two main GHGs emitted by the industry are methane (CH_4) and carbon dioxide (CO_2), and interventions must be carried out in the three segments of the industry, i.e. *upstream*, *midstream*, *downstream*.

In the *upstream* segment, almost all efforts should focus on reducing CH_4, while in the *midstream*segment, the main efforts should be directed towards technologies and procedures that reduce CO_2emissions, while in the *downstream* segment, resources should be distributed equally between the two.

Some of the actions in investments to be carried out can be according to (Anaya, 2024):

- Installation of compressors to capture the gas at the wellhead
- Use of efficient engines for propulsion of LNG tankers
- Targeted inspections and maintenance at remote sites to minimize leakage

The selection of the scenario you want to reach and the speed of arrival at that scenario will depend on each country's ability to invest. As presented in Annex I of this document, investments have an associated cost and investment capacity.

In the current energy and economic context, it is advisable to make investments in a first stage that maximize the cost/reduction ratio of the measure subject to its financing capacity. Likewise, it is important to make investments gradually, in order to incorporate best practices and technological improvements in the period 2025-2050, which will result in a reduction in costs and a technological improvement in processes.

Conclusions

The natural gas industry (NG and LNG) in LAC presents significant challenges to becoming a transition fuel towards a decarbonized global energy matrix.

These challenges are planned in two aspects, the first related to the production and transport capacity of the resource, in order to be a substitute for other energy sources that generate more GHGs, while the second focuses on the decarbonization of their own production processes.

As a transitional fuel, its main role in the region is associated with the substitution of other hydrocarbons and coal as the base energy of thermoelectric plants. This can also be done by incorporating other types of gases (biogas, hydrogen) low in GHG emissions together with NG.

Another sector where it has an important opportunity for expansion is the industrial sector, replacing other energy sectors for thermal and chemical processes.

For this, it is important to have the appropriate infrastructure, in order to guarantee the reliable supply to the consumption centers. LAC is a heterogeneous region in terms of gas transport infrastructures, so there are two options for an increase to advance in this sector. The first is linked to the expansion and interconnections of existing gas pipelines, while the second is linked to LNG processes (liquefaction and regasification), this option providing the advantage of diversification of suppliers/customers, whether the country is an exporter or importer of the resource.

LAC is a region with a strong presence of renewable energies in its energy matrix, which facilitates having comparative advantages for the production of green hydrogen, which by incorporating it together with NG, lowers the total GHG emissions of the sector.

It is important, even more so when taking into account that NG is not a zero-emission energy, to demonstrate through certification processes, the reduction in emissions of the production cycle of each company, in each of the producing countries, which will result in a competitive advantage for the entire region.

Bibliography

Anaya, F. (2024). *Certificación de Gas Natural de Bajas Emisiones en América Latina y el Caribe.* Quito: OLADE.

ARPEL. (30 de 12 de 2024). *Asociación de empresas de petróleo, gas y energía renovable de América Latina y el Caribe.* Obtenido de https://www.arpel.org/noticias/white-paper-y-webinar-gas-natural-en-la-transici%C3%B3n-hacia-econom%C3%ADas-con-bajas-emisiones-de-carbono-el-caso-de-america-latina-y-el-caribe

Energy Institute. (2024). *Statistical Review of World Energy.* Londres: Energy Institute. Obtenido de https://www.energyinst.org/statistical-review/home

Global Energy Monitor. (30 de 12 de 2024). *Infraestructura global de gas*. Obtenido de https://globalenergymonitor.org/projects/global-gas-infrastructure-tracker/

González, M., Ferragut, P., & Koutoudjian, G. (2023). *White Paper. Natural in de Transition to Low Carbon- Economies.* IGU-ARPEL-OLADE. Obtenido de https://www.arpel.org/noticias/white-paper-y-webinar-gas-natural-en-la-transici%C3%B3n-hacia-econom%C3%ADas-con-bajas-emisiones-de-carbono-el-caso-de-america-latina-y-el-caribe

International Association of LNG Importers (GIIGNL). (2023). *The LNG industry. GIIGNL Annual Report. International Group of Liquefied Natural Gas Importers.* Neuilly-sur-Seine – France: GIIGNL. Obtenido de https://giignl.org/wp-content/uploads/2023/07/GIIGNL-2023-Annual-Report-July20.pdf

OLADE. (2024). *Cadena de valor del gas natural en América Latina y el Caribe.* QUITO: OLADE.

OLADE. (2024). *Panorama Energético 2024 de América Latina y el Caribe.* Quito: OLADE. Obtenido de https://www.olade.org/noticias/panorama-energetico-2024-de-america-latina-y-el-caribe/

SieLAC OLADE. (30 de 12 de 2024). *Organización Latinoamericana de Energía*. Obtenido de SIELAC: https://sielac.olade.org/WebForms/Reportes/ReporteDato3.aspx?oc=58&or=670&ss=2&v=1

ANNEX I

Cost tables and technologies for the reduction of GHG emissions from the gas industry. Extracted from "Certification of Low-Emission Natural Gas in Latin America and the Caribbean. Ambition and investment requirements" (Anaya, 2024).

No	Emission source	Reduction technology	Methane reduction potential	CAPEX (USD)	Extraction	Processing	Transport (gas pipelines)	Liquefaction	Storage	Transportation (maritime)	Regasification
1	Water storage tanks.	Changing the water tank mantle from natural gas to CO_2 gas	57 thousand m³/year per tank (90%)	1,000 – 10,000		✓					
2	Gas pipelines	Gas recovery from pipeline cleaning operations	605 thousand m³/year per application (>90%)	10,000 - 50,000	✓	✓	✓				
3	Gas pipelines (valves and valve stem seal)	Targeted inspections and maintenance at remote sites	11 thousand m³/year per component (>90%)	500 - 1,000			✓				
4	Surface installations (valves, pumps, pipes, flanges, others).	Targeted Inspection and Maintenance at Surface Facilities	0.8 - 6 thousand m³/year per season (>90%)	1,000 – 10,000			✓				
5	Gas pipelines	Targeted inspection and maintenance at compressor stations	850 thousand m³/year per season (97%)	10,000 - 50,000			✓				
6	Processing plants (compressors and other equipment)	Targeted inspection and maintenance in processing plants	1,270 - 3,625 thousand m³/year per plant (>96%)	10,000 - 80,000		✓	✓				
7	Compressors	Wet seal degassing recovery system for centrifugal compressors	850 thousand m³ CH_4/year per compressor (96%)	33,000 - 90,000	✓	✓	✓	✓	✓	✓	✓
8	Compressors	Replacement of rod compressor packing system	25 thousand m³/year per compressor (60%)	1,000 – 10,000	✓	✓	✓	✓	✓	✓	✓
9	Safety valves	Pressure safety valve testing and repair	3.5 - 70 thousand m³/year per valve (80%)	250 - 1,000	✓	✓	✓	✓	✓	✓	✓
10	Compressors	Replacement of compressor cylinder unloaders	100 thousand m³/year per compressor (>90%)	40,000 - 50,000	✓	✓	✓	✓	✓	✓	✓
11	Compressors	Redesign of purge systems and emergency stops	5 thousand m³/year by closing or purging a compressor (50%)	1,000 – 10,000	✓	✓	✓	✓	✓	✓	✓

No	Emission source	Reduction technology	Methane reduction potential	CAPEX (USD)	Extraction	Processing	Transport (gas pipelines)	Liquefaction	Storage	Transportation (maritime)	Regasification
12	Compressors and tanks	Installation of flares	57 thousand m^3/year per flare (50%)	10,000 - 50,000	✓	✓	✓	✓	✓	✓	✓
13	Compressors and tanks, other	Installation of electronic flare ignition devices	56 m^3/year per device (100%)	1,000 – 10,000	✓	✓	✓	✓	✓	✓	✓
14	Dehydrator	Skimmer gas redirection	215 thousand m^3/year per unit (95%)	1,000 – 10,000	✓	✓	✓				
15	Dehydrator	Glycol dehydrator piping connection to vapor recovery unit	22 thousand m^3/year per unit (90%)	1,000 – 10,000	✓	✓	✓				
16	Dehydrator	Replacement of glycol dehydrator units with methanol injection	23 thousand m^3/year per unit (90%)	1,000 – 10,000	✓	✓	✓				
17	Dehydrator	Use of portable desiccant dehydrators in production wells	54 thousand m^3/year per application (>90%)	1,000 – 10,000	✓	✓	✓				
18	Dehydrator	Zero-emission dehydrators	890 thousand m^3/year per application (100%)	20,000 - 60,000	✓	✓	✓				
19	Dehydrator	Optimization of glycol circulation and installation of flash tank separators in glycol dehydrators	510 thousand m^3/year for optimization and 170 thousand m^3/year for separator (90%)	10,000 - 50,000	✓	✓	✓				
20	Dehydrator, wells, pipes	Replacement of gas pumps with electric pumps	84 thousand - 226 thousand m^3/year per pump (100%)	2,000 - 15,000	✓	✓	✓				
21	Controls	Convert pneumatic controls to mechanical controls	65 thousand m^3/year per controller (95%)	1,000 – 5,000	✓	✓	✓	✓	✓	✓	✓
22	Dehydrator	Replacement of glycol dehydrators with desiccant dehydrators	16 thousand m^3/year per unit (90%)	10,000 - 50,000	✓	✓	✓				
23	Controls (pressure, flow, other)	Replacement of pneumatic gas controls with compressed air controls	566 thousand m^3 CH_4/year per installation (100%)	50,000 - 60,000	✓	✓	✓	✓	✓	✓	✓
24	Well	Connecting the wellhead to a steam recovery unit	206 thousand m^3/year per well (98%)	1,000 – 10,000	✓		✓				
25	Well	Installation of plunger gas lift systems	325 thousand m^3/year per well (65%)	1,000 – 10,000	✓		✓				
26	Well	Installation of compressors to capture the gas at the wellhead	930 thousand m^3/year per compressor (>90%)	10,000 - 50,000	✓		✓				

No	Emission source	Reduction technology	Methane reduction potential	CAPEX (USD)	Extraction	Processing	Transport (gas pipelines)	Liquefaction	Storage	Transportation (maritime)	Regasification
27	Well	Alternatives to remove accumulated fluid and improve flow in gas wells	14 thousand - 725 thousand m³/year per well	10,000 - 70,000	✓		✓				
28	Ships	Use of efficient engines for propulsion of LNG tankers	50%	10,000			✓			✓	
29	Compressors	Replacement of traditional compressors with electric ones	185 thousand m³/year per compressor (100%)	1,200,000	✓	✓	✓	✓	✓	✓	✓
30	Compressors	Install electric motor starters	38 thousand m³/year per starter system (100%)	1,000 – 10,000	✓	✓	✓	✓	✓	✓	✓

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