

A COMPARATIVE ANALYSIS OF ENERGY TRANSITION IN LATIN AMERICA AND EUROPE



A COMPARATIVE ANALYSIS OF ENERGY TRANSITION IN LATIN AMERICA AND EUROPE

ORGANIZATION

 **FGV ENERGIA**

SUPPORT

 **Konrad
Adenauer
Stiftung**

DIRECTOR

Carlos Otavio de Vasconcellos Quintella

TECHNICAL TEAM

Lavinia Hollanda Júlia Febraro
Rafael Nogueira Mônica Varejão
Camilo Muñoz Tatiana Bruce da Silva

FGV Energy's research team would like to thank: José Maria Valenzuela (Coordinator of Energy Policy at WWF and former director of Sustainability at Mexico's Energy Department); Jatziri Pando (head of the Climate Change Committee at the Mexican Senate); Hernán Carlino (coordinator of the Centro de Estudios en Global Climate Change at Fundacion Torcuato di Tella, Argentina); Gerardo Rabinovich (researcher at the Centro de Estudios en Global Climate Change at Fundacion Torcuato di Tella, Argentina); and Susana Kahn (associate professor at the Federal University of Rio de Janeiro and executive coordinator of the Green Fund Project at the Federal University of Rio de Janeiro) for their help in writing this paper.

**PUBLISHER**

Christian Hübner

TRANSLATION

Grupo Language Link Eventos Ltda.

TECHNICAL TEAM

Publishing Coordination
Karina Marzano

REVIEW

Fidelity Translations

DESIGN AND LAYOUT

Maria Clara Thedim
www.mathedim.com.br

Index

ENERGY TRANSITION UNDER THE PERSPECTIVE OF THE PARIS AGREEMENT	05
THE DETERMINANTS OF DIFFERENT EXPERIENCES IN ENERGY TRANSITION	13
Natural resources and economics in Latin America	19
ENERGY TRANSITION IN LATIN AMERICA - INITIATIVES AND CHALLENGES	33
iNDC	38
Existing initiatives	39
Energy transition challenges	44
PUBLIC ENGAGEMENT IN ENERGY TRANSITION	53
CONCLUSION	59
REFERENCES	62



Energy transition under the perspective of the Paris Agreement

The Paris Agreement¹, approved by 195 countries during UNFCCC's 21st Conference of the Parties (COP 21) in December 2015, is a milestone for policies for fighting against climate change. The Agreement's main goal is to limit temperature increase during this century to levels substantially lower than 2°C in relation to pre-industrial levels and to engender efforts to limit that increase to 1.5°C. The high adhesion of countries on the first date available for subscription² indicates that the world is inexorably moving towards a low carbon economy.

The terms of the agreement are comprehensive and ambitious, based on common but differentiated responsibilities among countries. This means that while all countries should contribute to reducing greenhouse gas emissions (GHGs), their contributions will be different and take into account the historical and current emission standards in each country, as well as their ability to contribute to fighting against climate change. Thus, each country will choose its path to reduce emissions by setting policies to decarbonise the various segments of the economy - including land use, transportation, industry and energy.

This will not be an easy task. According to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change³, anthropogenic emissions increased substantially between 1970 and 2010, and accelerated in the last decade of this period - growth of 2.2% per year between 2000-2010, compared to 1.3 % per year between 1970-2000. Except for the agriculture, forestry and land use sectors (AFOLU - *Agriculture, Forestry and Other Land Use*), all sectors have been showing increased emissions since 2000, mainly the energy and industry sectors, which account for 47% and 30% of this growth, respectively. The energy

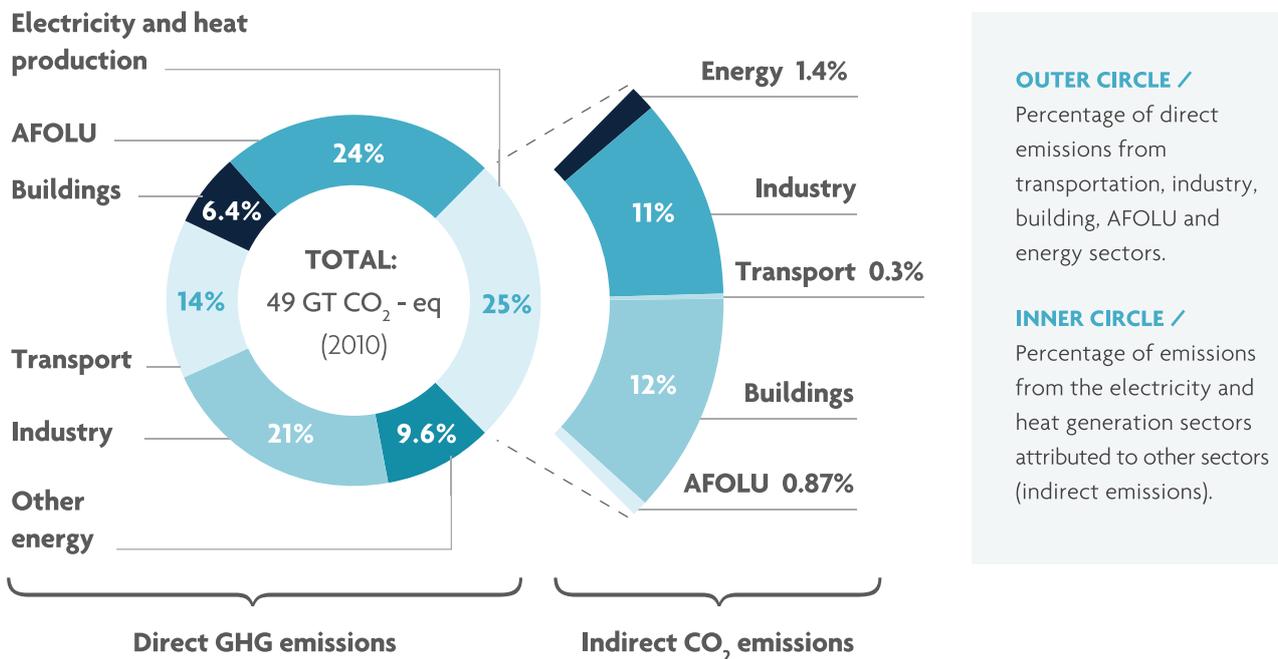
-
1. Hereinafter referred to as the Agreement.
 2. 175 countries - 174 plus the European Union signed the agreement on 04/22/2016.
 3. Intergovernmental Panel on Climate Change (IPCC). *Climate Change*, 2014.

sector is the largest global contributor to GHG emissions, accounting for approximately 35% of total emissions in 2010. Thus, a sustainable

energy transition to a low carbon economy will play an important role in promoting changes in the global climate scenario.

FIGURE 1 – GHG EMISSIONS PER SECTOR - 2010

TOTAL ANTHROPOGENIC GHG EMISSIONS IN GTCO₂-EQ/YEAR⁴



Source: *Climate Change 2014 Synthesis Report, IPCC, Page 47.*

However, energy guidelines and contribution goals for the sector in several countries and regions will be different in many aspects. Recent global demand scenarios show different rates for energy transition in the world (box). In particular, the Agreement led several energy institutions and

companies to review their demand scenarios in order to incorporate the 2°C limit for global temperature increase agreed at COP 21 into their forecasts. With this, the traditional view that the growth in population and income would lead to a growing demand for fossil fuels – mainly oil – has

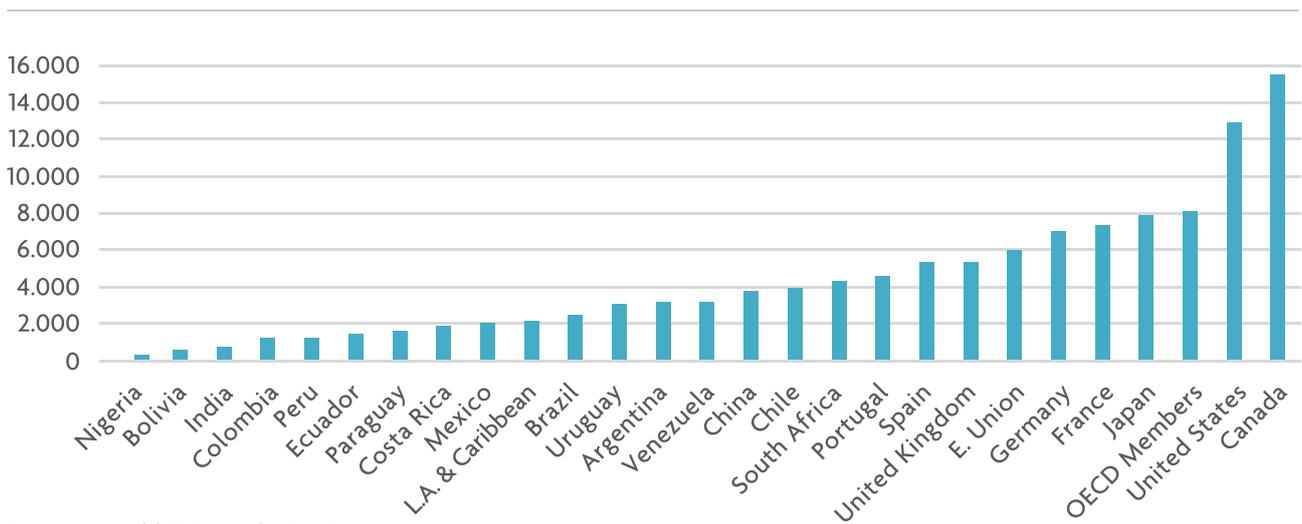
4. CO₂ is the main gas contributing to the greenhouse effect, being used as a common scale for calculating GHG emissions, presented in tons of CO₂ equivalent (tCO₂-eq). This measure takes into account the emissions of each gas multiplied by its global warming potential (GWP) at a time horizon of 100 years. Available at: http://unfccc.int/files/kyoto_protocol/application/pdf/kp_doha_amendment_english.pdf.

been challenged. As a result of climate policies, the perception is that there will be a peak in oil demand in the next few decades⁵.

Among the factors that will influence the speed of this transition are technological advances – in particular clean technologies – access to funding and the development of appropriate public policies and regulatory framework. Such challenges will

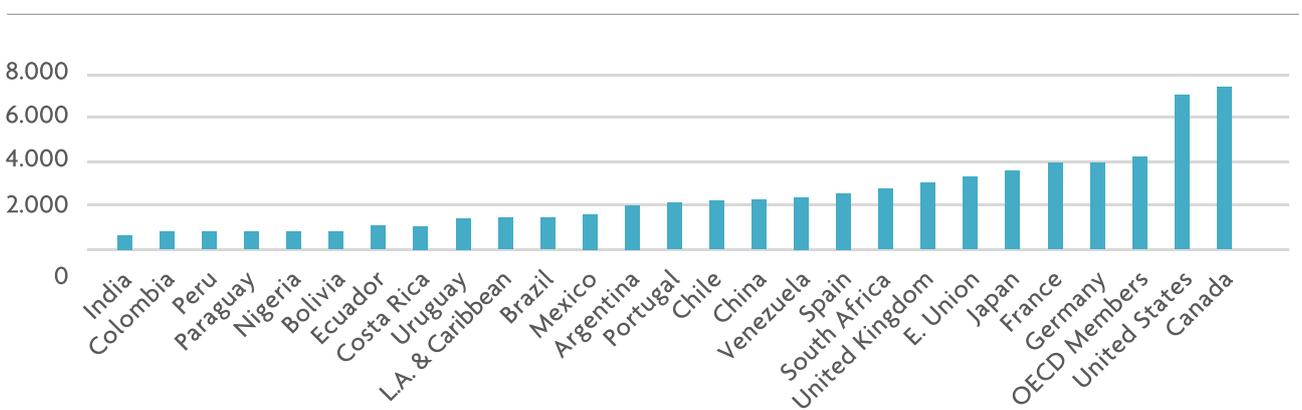
reflect in the progress of this transition in the world as a whole, but tend to impact even more significantly developing countries where markets tend to be less mature and the expectations are for a strong growth in energy demand – usually associated to economic growth. In practice, both developing and developed countries will achieve energy transition towards a cleaner energy mix at a different pace.

FIGURE 2 – ANNUAL ELECTRICITY CONSUMPTION - 2013 (KWH PER CAPITA)



Source: World DataBank, 2013.

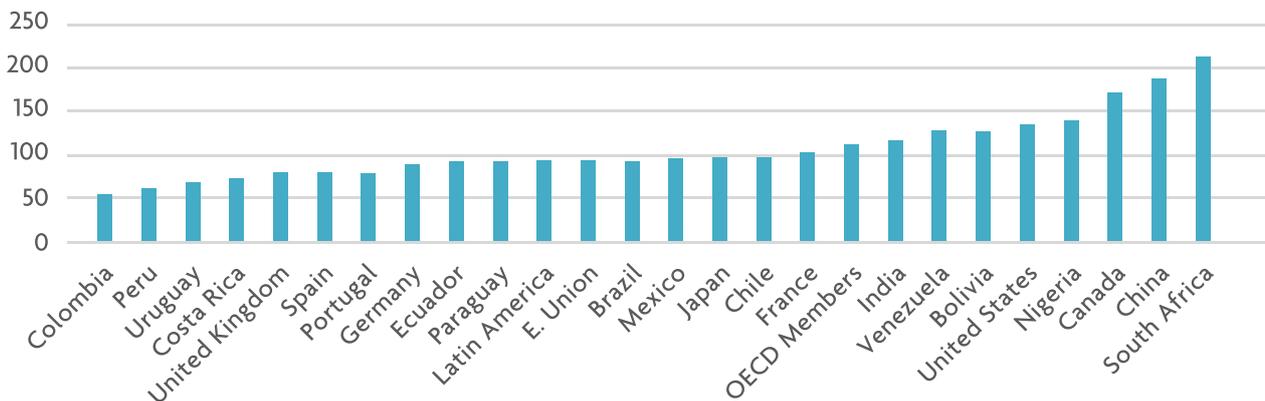
FIGURE 3 – ANNUAL ENERGY CONSUMPTION (KG OIL EQUIVALENT PER CAPITA)



Source: World DataBank, 2013.

5. WEF, 2016.

FIGURA 4 – ENERGY INTENSITY (KG OIL EQUIVALENT PER GDP)



Source: World DataBank, 2013.

In order to better understand these different developments, this study will focus on the analysis of challenges and opportunities for energy transition in Latin America through the assessment of data of selected countries given as examples. This analysis starts with the presentation of these countries' current political and economic structure and conditions, as well as the availability of natural resources and funds. In particular, it is essential to prioritize an agenda of macroeconomic and political reforms in several countries in the region in order to attract investments that are important for the development of an infrastructure that is compatible with the adoption of new clean technologies. In

this context, we discuss public policy initiatives in the energy sector and the challenges each country faces towards a low carbon economy.

Finally, we discuss the different levels of society engagement regarding the climate agenda of each observed country in Europe and Latin America. Discussing the region's peculiarities in addressing the energy transition may contribute to a better understanding of important aspects of the energy policy in each country and help build a convergent vision about the relation between energy and climate change in the world.

HISTORICAL PERSPECTIVE OF THE PARIS AGREEMENT

The 5th IPCC report shows that growth in GHG emissions reached an all-time high in 2010 at 49 gigatons of CO₂ equivalent (GtCO₂eq). Between 2000 and 2010, anthropogenic GHG emissions increased by nearly 10 GtCO₂eq, with about 78% of this increase relating to the burning of fossil fuels and industrial processes. Carbon dioxide (CO₂) remained the main anthropogenic greenhouse gas, representing 76% of total GHG emissions that year.

The Report's data made clear the importance of the energy sector in initiatives to reduce emissions. Economic and demographic growth are directly related to the increase in energy consumption – and, consequently, for GHG emissions. Therefore, energy planning must take into consideration the climate change scene and additional efforts must be made in order to limit the sector's emissions, particularly in developing countries where there is an expectation for increased demand for energy.

The 2009 Conference of the Parties (COP15), in Copenhagen, set the target to limit the increase in the average global temperature throughout the twenty-first century at 2°C based on pre-industrial levels. To achieve this goal, the GHG emissions mitigation scenarios presented in the Report indicate that the concentration of CO₂ in the atmosphere in 2100 should remain stable at 450 parts per million (ppm). In this scenario, the models suggest that it would be necessary to reduce cumulative emissions in the twenty-first century from 2,460 GtCO₂ to 1,800 GtCO₂ globally⁶.

At COP 15, the top-down system for setting emission reduction targets proved politically unfeasible. The top down approach is based on legally binding commitments, managed by multilateral institutions - such is the case for the Kyoto Protocol. The support of national governments to this approach was insufficient, mainly because of their reluctance to accept rigid commitments to reduce emissions and the monitoring by an international institution. In particular, only the countries listed in Annex I (industrialized countries and transition economies from the former Soviet bloc) had targets for reducing greenhouse gas emissions - which left out countries like India and China.

6. Intergovernmental Panel on Climate Change (IPCC). Climate Change, 2007.

COP 21 in Paris adopted a bottom-up system for setting emission reduction targets for countries besides those listed in Annex I. The system is based on the principle of common but differentiated responsibilities, in which each country sets its own goals and initiatives for adaptation and mitigation based on the composition of its energy mix and the availability of energy resources and funds. In other words, the existence of different responsibilities and different capacities is acknowledged, but it was established that each country should contribute according to its possibility. Thus, the Paris Conference achieved a significant accession of countries - 189⁷ countries sent their contribution goals or Intended Nationally Determined Contributions (iNDCs).

However, it is understood that the commitments established by countries in their iNDCs are not enough to maintain the increase in average global temperature below 2°C. Thus, governments agreed to establish a regular process of reviewing the targets every five years with the objective of establishing more ambitious targets with every review. Transparency and accountability mechanisms were also established, based on the approach of mitigation actions that are "Measurable, Reportable and Verifiable" (MRV)⁸. The goal is to quantify the impacts of mitigation actions and enable monitoring the effective implementation of iNDCs by countries.

7. World Resources Institute (WRI). *CAIT Climate Data Explorer: Paris Contribution Map*.

8. *Climate Policy Info Hub. International Climate Policy Architectures: Top-Down and Bottom-Up*.





The Determinants of Different Experiences in Energy Transition

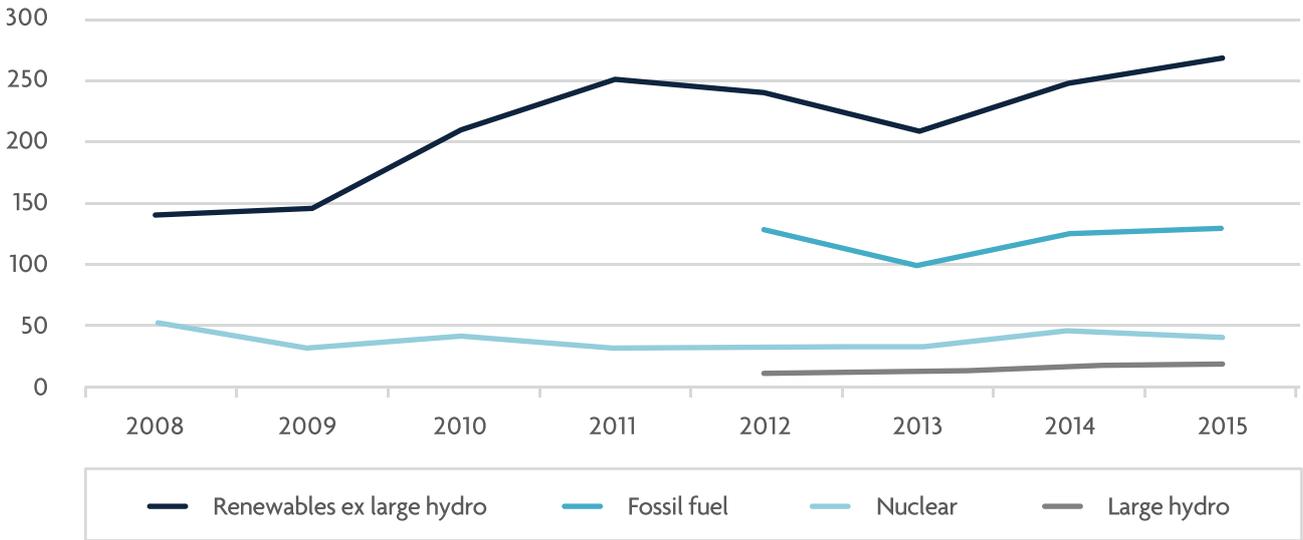
The climate agenda is gaining more importance in defining the processes of public policies and energy planning in various countries and regions. These countries, however, do not have uniform energy transition policies. This chapter will discuss, first, why energy transition policies in Latin America and Europe are different. Next, the economic and energy characteristics of each Latin American country, which can impact their energy transition agenda, of Latin American countries will be discussed.

The growing concern about climate change is reflected by the rise in clean energy investments around the globe. In electricity generation, renewable energy attracted twice the amount invested in fossil fuels in 2015 - \$130 billion. Furthermore,

according to the International Energy Agency (IEA) Executive Director, investments in the oil sector fell 20% in 2015, and are expected to decline in 2016 as well. This will negatively impact oil production growth in the coming years⁹.

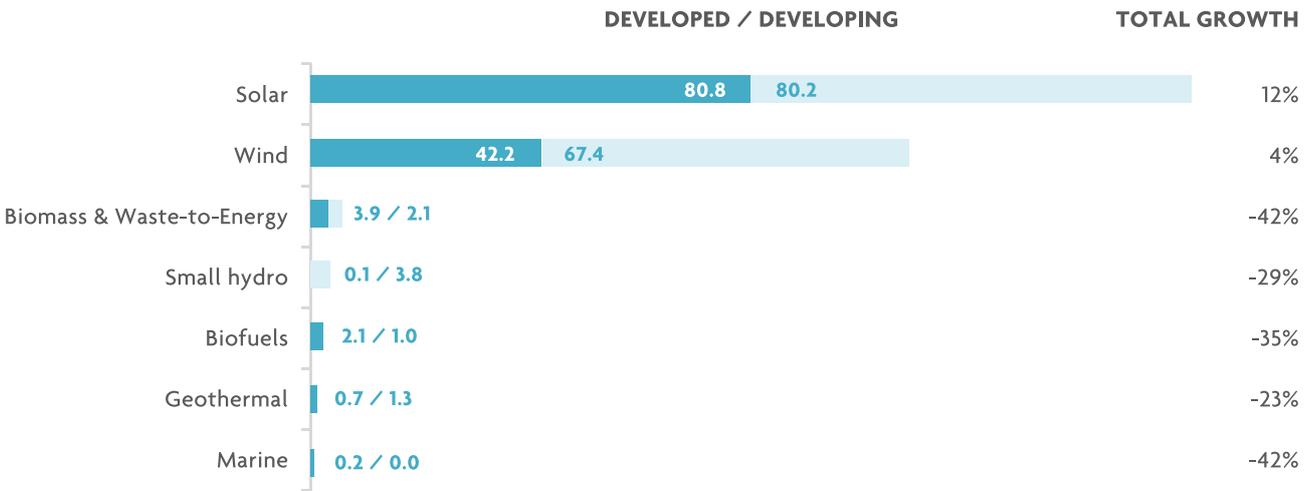
9. Available at <http://www.wsj.com/articles/low-oil-gas-investment-to-have-long-term-impact-on-supply-iea-chief-says-1448290926>.

FIGURE 5 – INVESTMENT IN POWER CAPACITY – RENEWABLE, FOSSIL-FUEL AND NUCLEAR, 2008-2015, US\$BN



Source: "Global Trends in Renewable Energy Investment 2016" – UNEP, Bloomberg New Energy Finance.

FIGURE 6 – GLOBAL NEW INVESTMENT IN RENEWABLE ENERGY: DEVELOPED V DEVELOPING COUNTRIES, 2015, AND TOTAL GROWTH ON 2014, US\$BN



Note: Total values include estimates for undisclosed deals. New investment volume adjusts for re-invested equity. Includes estimates for small distributed capacity, corporate and government R&D. Developed volumes are based on OECD countries excluding Mexico, Chile and Turkey.

Source: "Global Trends in Renewable Energy Investment 2016" – UNEP, Bloomberg New Energy Finance.

Developed countries have invested mainly in solar energy, while developing countries have prioritized investments in wind power

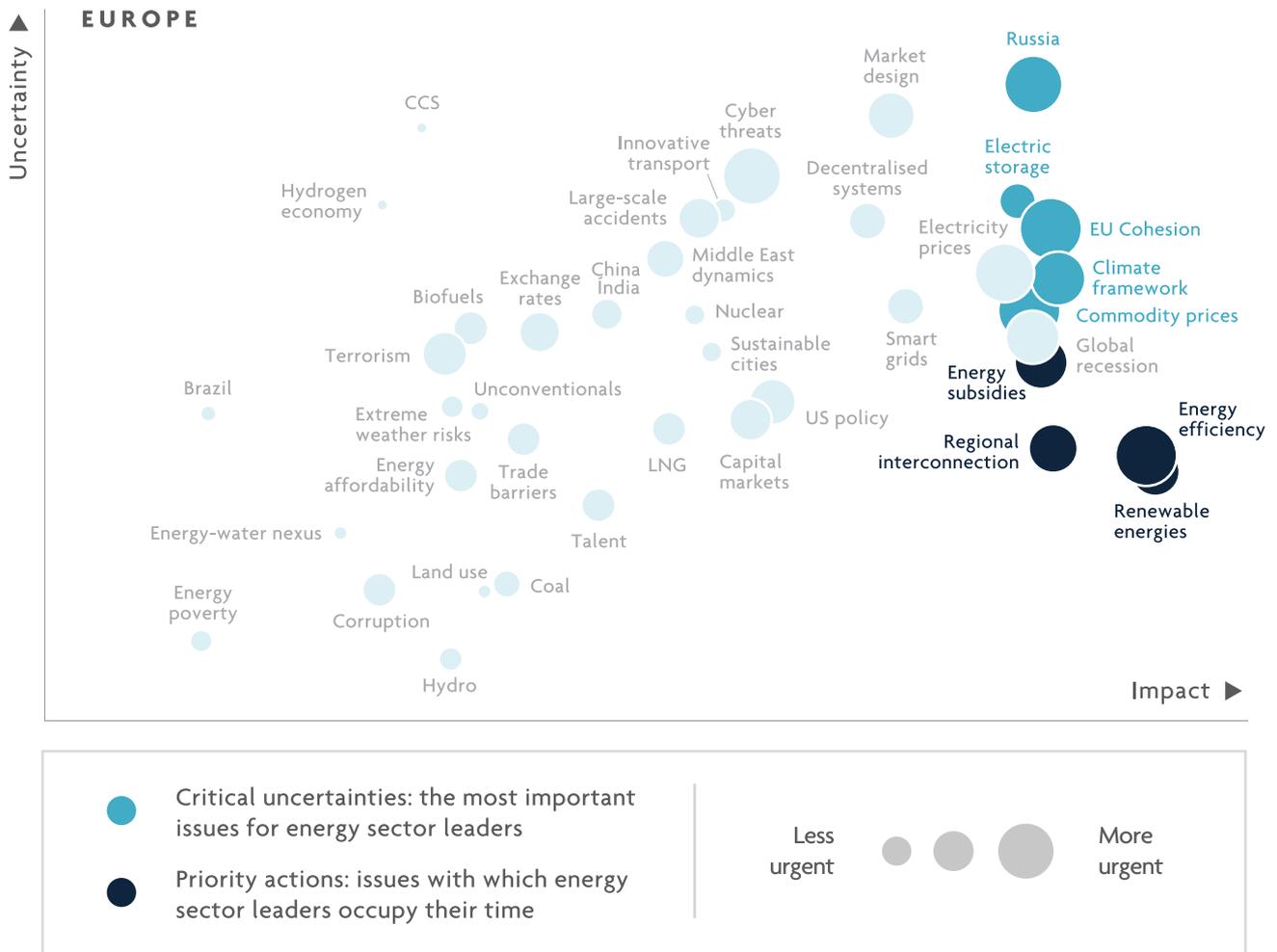
A more detailed look at these data shows that developed countries have invested mainly in solar energy, while developing countries have prioritized investments in wind power. This difference is possibly related to the fact that solar energy projects are largely distributed - which usually involves the creation of new business models. The successful implementation of such models, in turn, is strongly related to political and economic stability, the country's institutional and regulatory environment and the maturity of its market - which is usually higher in developed countries.

Besides the usual challenges regarding technical issues and the allocation of natural resources, the political and economic structure has enormous influence on the evolution of a country's climate agenda and decisions to invest in the energy sector. Europe, led by Germany, has been increasing efforts towards transitioning to a more renewable energy matrix. However, although European countries also face political and economic challenges for the dissemination of clean energy in the continent, in Latin America, economic growth and the search for political stability play a stronger role on technical issues and resource allocation. At this time, Latin American governments are largely concerned about solving these issues.

These two regions, which possess different political and economic agendas and structures, have, consequently, different energy transition paces. Moreover, as a direct consequence of the political and economic structures of each region, the different development levels of financing and promotion mechanisms will affect the energy transition's speed and shape in Europe and Latin America.

The World Energy Issues Monitor (WEIM), a report published by the World Economic Council based on research carried out in 90 countries, delineate the main uncertainties and priority actions for the energy sector in both regions. The survey, which interviewed about 1,200 leaders of the energy sector, addresses issues related to macroeconomic risks, geopolitics, business environment and trends, and energy technologies. The respondents' answers are depicted in graphics, according to three dimensions: (i) the potential impact of a particular topic relevant to the energy sector (x-axis), (ii) the level of uncertainty associated with this impact (y-axis) and (iii) the urgency of the issue (represented by the size of the circle). The critical uncertainties are topics that the industry should pay attention to since they have high impact and high uncertainty. Issues with high impact and low uncertainty represent action priorities for industry leaders. The report's conclusions on Europe are illustrated in the chart below.

FIGURE 7 – CRITICAL UNCERTAINTIES AND ACTION PRIORITIES FOR EUROPE - WORLD ENERGY ISSUES MONITOR



Source: World Energy Issues Monitor, 2016.

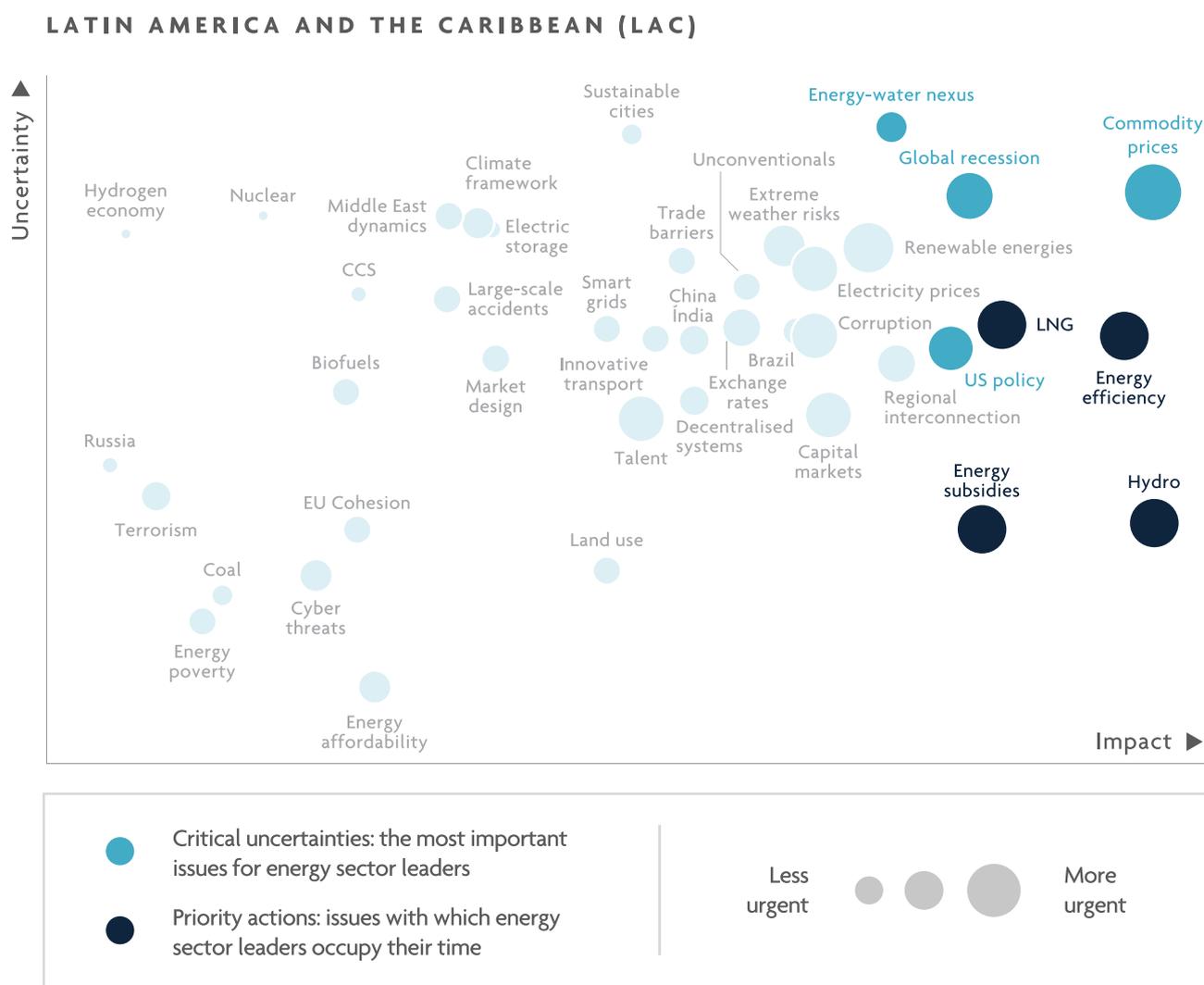
Among the critical uncertainties, the report shows that regional geopolitical issues are more important nowadays in the energy scene than global issues, which had been dominating the European energy agenda in recent years. Particularly, the increasing geopolitical uncertainty is linked to concerns about Russia, the future of the European Union, and the impact of the growing influx of immigrants in the region.

On another front, the discussion on energy markets design was mentioned, mainly due to the growing share of renewables in the energy sector. Concurrently, issues related to technological solutions and decentralized energy systems - such as storage technologies, for example - appear to have more importance in Europe, and technological advancement begins to influence investment

decisions. Finally, climate issues and COP21 are very important to energy sector leaders in Europe, despite current uncertainties regarding how to effectively implement the agreement and its practical implication for governments and the private sector.

As for action priorities - issues with high impact and low uncertainty - the report shows decreasing uncertainty regarding regional interconnection as a result of expanding investments in interconnection in Europe. Similarly, investments in energy efficiency projects and renewable energy are positively recognized, especially due to their cost reduction.

FIGURE 8 – CRITICAL UNCERTAINTIES AND ACTION PRIORITIES FOR LATIN AMERICA - WORLD ENERGY ISSUES MONITOR



The investment capacity of Latin American national governments has been reduced to a great extent, increasing the need for foreign investment attraction in these countries

As for Latin America and the Caribbean (LAC), the report shows that the drop in oil prices and other commodities stands out as the main critical uncertainty for energy sector leaders in the region. Despite also being a concern in Europe, lower commodity prices have a higher direct and indirect impact in Latin American economies— mostly in commodity exporting countries such as Chile¹⁰ and Venezuela¹¹, for instance. Likewise, uncertainties regarding global demand for the region's goods and the American foreign and monetary policies appear at the top of the Latin American leaders' list of concerns – the latter in particular due to the potential impact on foreign investments in energy and infrastructure in the region.

Combined with political turmoil and corruption scandals in some Latin American countries, low commodity prices and reduced global demand resulted in huge macroeconomic difficulties, which affected the energy sector directly - in particular, the National Oil Companies. In general, the region's countries showed low economic growth, currency devaluation, growing inflation and unemployment levels, as well as strong fiscal instability. Thus, the investment capacity of Latin American

national governments has been reduced to a great extent, increasing the need for foreign investment attraction in these countries.

The strong dependence of some countries on hydropower is reflected both in policies that prioritize this type of energy, and in the great concern about the vulnerability of energy systems to hydrological cycles - bringing the water-energy issue to the list of critical uncertainties. The lower concern regarding interconnection between countries (compared to the results of the 2015 survey), coupled with strong prioritization of policies for the LNG market, as shown in the chart, supports the idea¹² that LNG use, particularly to supply the electricity sector, is an alternative to regional integration. The complex political context, and particularly the wide availability of various natural resources, puts the countries of the region in a comfortable position with regard to energy security.

Like in Europe, some countries in the region - such as Ecuador, Colombia and Chile – prioritize actions that increase energy efficiency. Similarly, governments' subsidies to the energy sector

10. *Ores and metals accounted for over 50% of Chilean exports in 2014 (World Bank Data).*

11. *Oil and its by-products accounted for over 90% of total Venezuelan exports in 2014 (Atlas MIT).*

12. *Lins et al., 2015.*

remain a priority not only in Latin America and Europe, but also in other regions of the world (like Africa and the Middle East, for instance). Subsidies to the energy sector are generally included in a country political agenda, given their high population support. However, lower oil prices have offered the opportunity to reduce fuel subsidies in several countries¹³.

Two topics, which have lost relevance to the region's energy sector over the previous year, stand out in the report: (i) energy poverty and energy access; and (ii) climate policies. Regarding the former, there are about 22 million people without access to electricity, and about 65 million people rely on traditional biomass for cooking and heating in the Latin America and Caribbean region¹⁴. Thus, one would expect that access to energy would appear as an extremely relevant issue in the region. On the other hand, the region's economic deterioration may be responsible for the increasing importance of other macroeconomic issues more directly linked to job creation and income generation.

As for climate policies, lower uncertainty and the impact on the energy sector confirm the view that the opinions of industry leaders and the public about energy transition in developed and developing countries is quite different. In particular, macroeconomic and political issues are more pressing in developing countries, which results in their climate agenda being strongly connected to their economic development agenda.

NATURAL RESOURCES AND ECONOMICS IN LATIN AMERICA

The energy mix in Latin America, which relies less on fossil fuels than the global average, places the region ahead in the transition to a low carbon economy. About 70% of the energy demand in the region comes from fossil fuels, while the world average is 82%. If we consider only electricity generation, the share of fossil fuels drops to about 60% (compared to a global average of 73%). This is mainly due to a high participation of hydropower and the recent increase in the share of "new renewables" (solar, wind and biomass)¹⁵.

In addition, the region has enormous availability and diversity of natural resources - including reserves of fossil fuels, large hydro, wind and solar potential, as well as agricultural land and suitable weather conditions. For instance, data from SOLARGIS show that the maximum solar radiation in Germany, where about 21% of the electricity generation installed capacity comes from solar generation, is about 40% lower than the maximum solar radiation in Brazil, where installed capacity of solar generation is practically zero.

Similarly, the region also has significant reserves of fossil resources. According to the *World Energy Council*, in 2011, Latin America and the Caribbean had 44 billion tons of proven oil reserves - 40 billion only in Venezuela, followed by far by Brazil, with 2 billion tons. The region accounts for about 20% of global recoverable oil reserves. Regarding natural

13. http://energypolicy.columbia.edu/sites/default/files/energy/Fuel%20Subsidy%20Reform_October%202015.pdf.

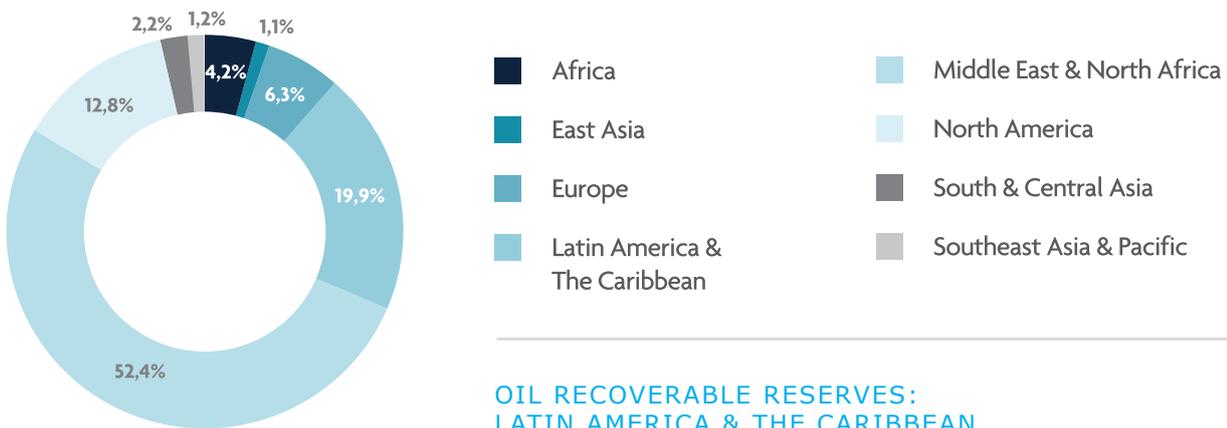
14. These numbers, however, can be considered relatively low compared to data from Africa and Asia, where there are, respectively, 635 million and 526 million people without access to electricity. Similarly, about 750 million people in Africa use traditional biomass, while in Asia this figure exceeds 1.5 billion people (*International Energy Agency (IEA). World Energy Outlook, 2015*).

15. IADB, 2013. Based on data from the EIA.

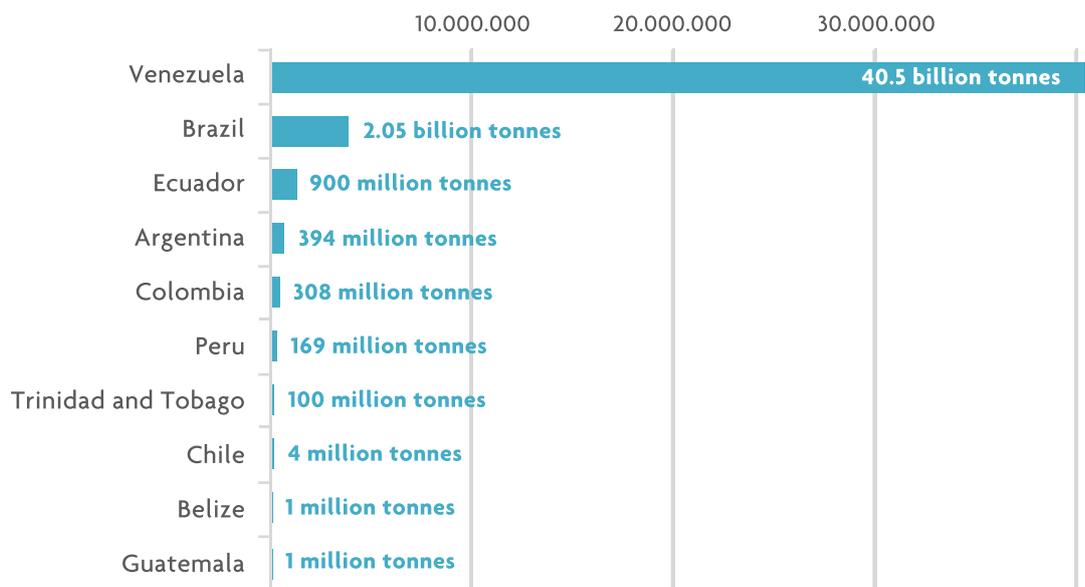
gas reserves, in 2011 the region accounted for 6.5 million tons of oil equivalent (Mtoe) – of which 5 Mtoe belong to Venezuela - and 3.6% of world reserves. The proven existence of coal reserves in the region, in turn, amounted to only 1.6% of world reserves in 2011.

Expected demand growth coupled with rising environmental restrictions to build new hydroelectric plants, in addition to national climate policies under the COP 21 that will eventually come into effect, indicate that the region’s countries need to find new ways to expand their energy availability.

FIGURE 9 – OIL RECOVERABLE RESERVES BY REGION

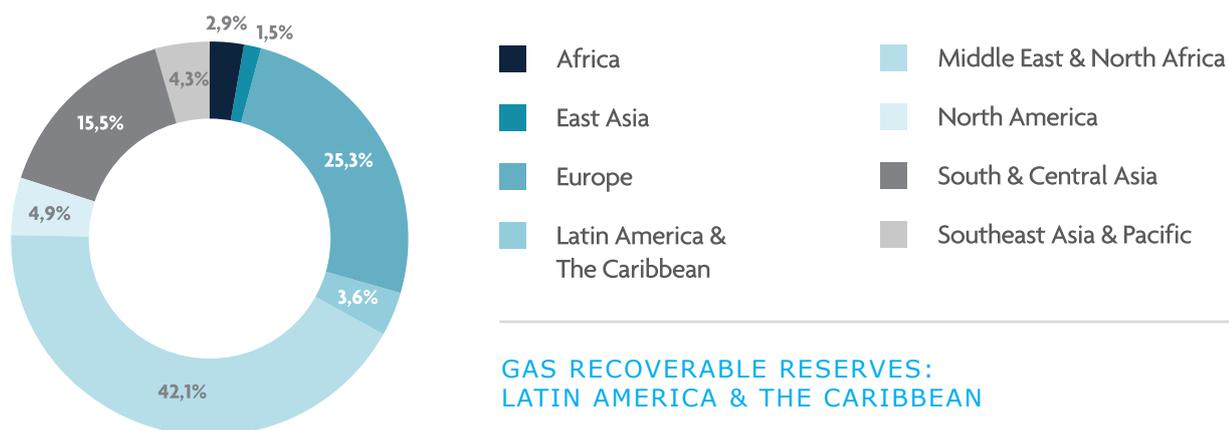


OIL RECOVERABLE RESERVES: LATIN AMERICA & THE CARIBBEAN

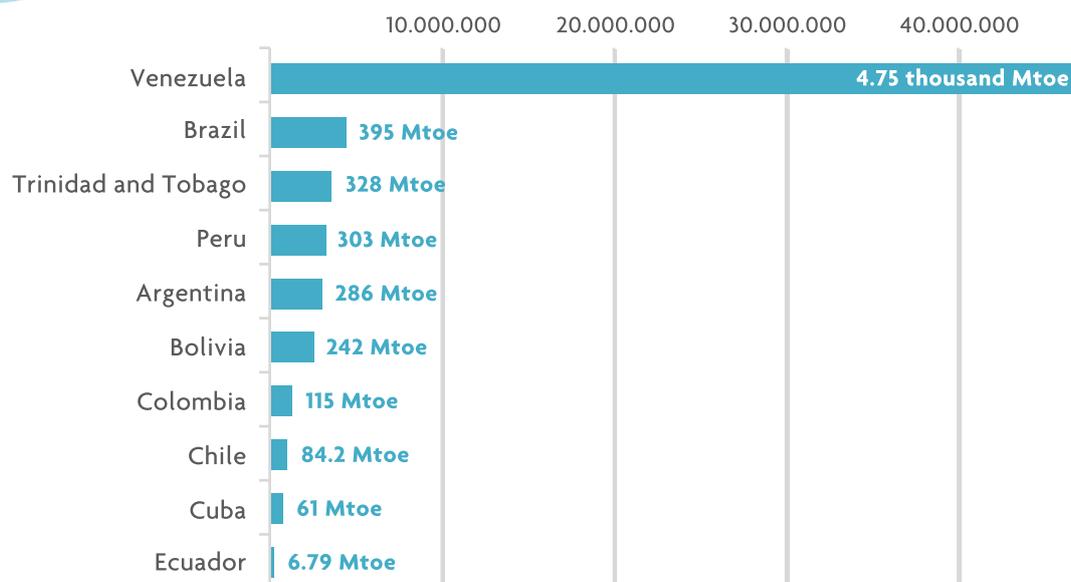


Source: World Energy Council, 2011. Accessed in June 2016.

FIGURE 10 – GAS RECOVERABLE RESERVES BY REGION



GAS RECOVERABLE RESERVES: LATIN AMERICA & THE CARIBBEAN



Source: World Energy Council, 2011. Accessed in June 2016.

Currently, the insertion of “new renewables” (solar, wind and biomass) and biofuels in the region’s energy mix is very diverse. In some cases, as in Argentina, the presence of other renewables, except for hydropower, is practically nonexistent.

In Uruguay, the share of renewables in the energy mix in 2015 reached about 57%, of which 40% corresponded to biomass, 13% to hydropower and about 4% to wind power.

COMPARISON BETWEEN LATIN AMERICA'S AND EUROPE'S ENERGY AND ELECTRICITY MIX – SELECTED COUNTRIES

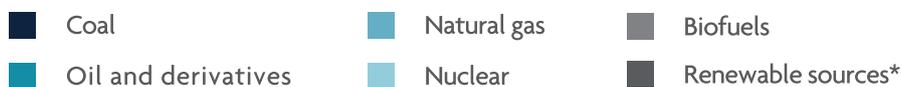
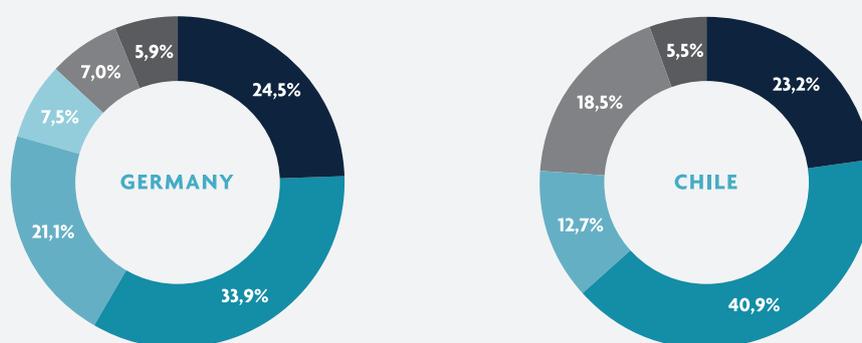
In order to compare the energy supply profile in Europe and Latin America, we raised information on the energy and electric mix of some countries in these regions. In Latin America, the selected countries were Argentina, Brazil, Chile, Costa Rica, Mexico and Uruguay. We compared these countries with France and Germany to better understand the current energy situation in Latin America.

ENERGY MIX

The share of mineral coal in a country's energy supply allows us to differentiate between energy mixes with a higher or lower level of CO₂ emissions. Thus, countries were divided into two groups. In the first group, coal participates strongly in the country's energy supply, usually representing more than 10% of the total supply. In the second group, coal plays a minor role in energy supply.

Within this categorization, Germany and Chile appear as countries where coal still has a high participation in the energy mix, representing 25% and 23% of total energy supply, respectively. In another group, France, Brazil, Mexico, Argentina, Uruguay and Costa Rica, coal supplies less than 10% of their energy. In addition, each country has developed different substitutes to coal. In France, nuclear power has an important share (43%). In Brazil and Uruguay, there is strong participation of biofuels and renewable sources, including hydroelectric generation. In Costa Rica, geothermal energy participation is added to biofuels and renewable sources. Finally, Mexico and Argentina preserved a low share of coal in their energy mix due to increased use of natural gas, which represents, respectively, 43% and 52% of the energy supply in these countries.

FIGURE 11 – COUNTRIES WHERE COAL REPRESENTS MORE THAN 10% OF THE TOTAL ENERGY SUPPLY

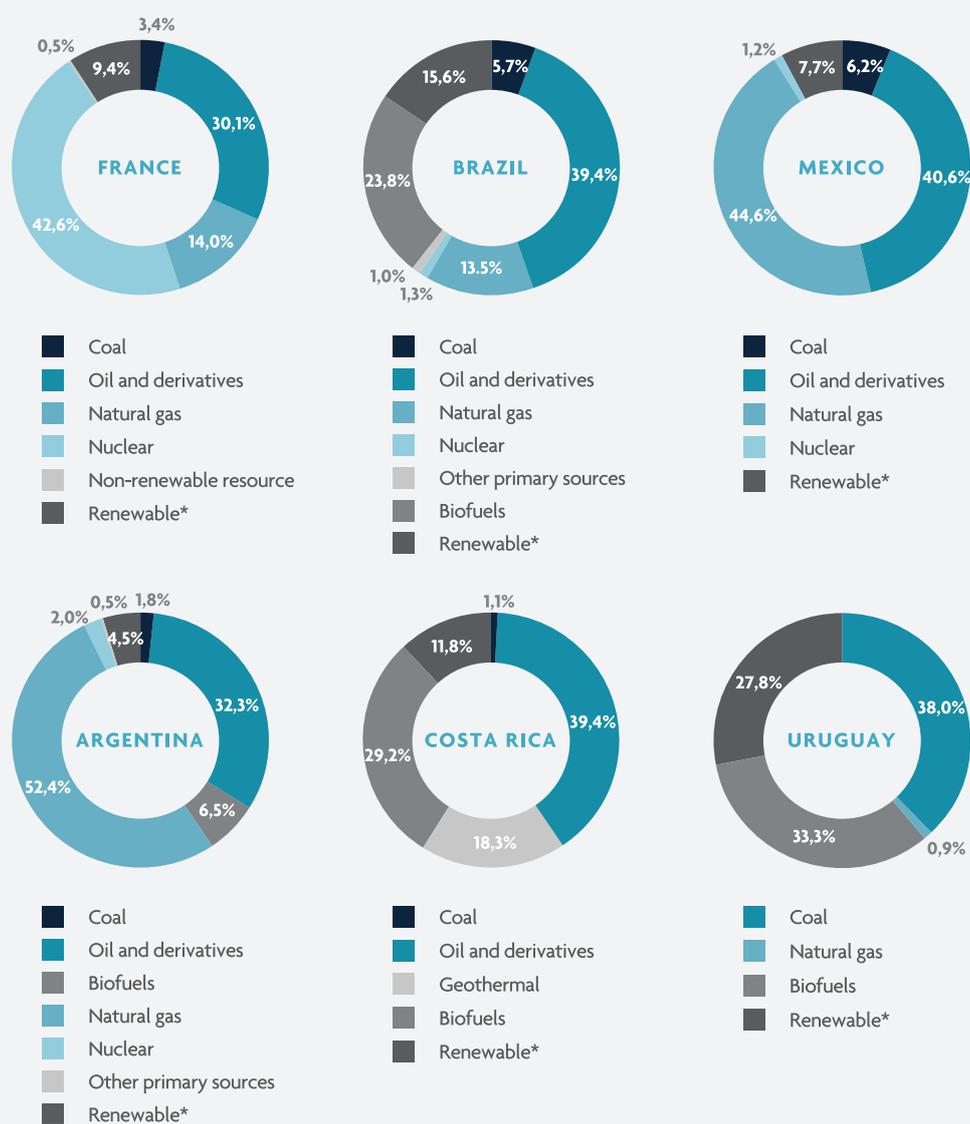


Note: *includes hydro for Germany and Mexico.

Fonte: Source: Prepared with data from *Energiedaten: Gesamtausgabe (Germany)* and *Ministerio de Energía Chile, Balance Nacional de Energía (BNE) 2014 (Chile)*.

This classification is interesting for two reasons. First, coal and oil are the most polluting energy sources consumed by the countries analyzed. However, coal is easier to replace than oil, as it is commonly used to generate electricity and heat. In all countries surveyed, oil has a captive market, which represents 30% to 40% of the total energy supply. This market is intrinsically related to oil consumption in the transport sector, one of the main challenges faced by CO₂ emission reduction policy-makers. Moreover, in countries where coal does not have strong participation in the energy supply, cleaner energy alternatives emerge as substitutes, mainly in electricity generation, instead of allowing for an expansion of oil and its subproducts consumption.

FIGURE 12 – COUNTRIES WHERE COAL REPRESENTS LESS THAN 10% OF THE TOTAL ENERGY SUPPLY



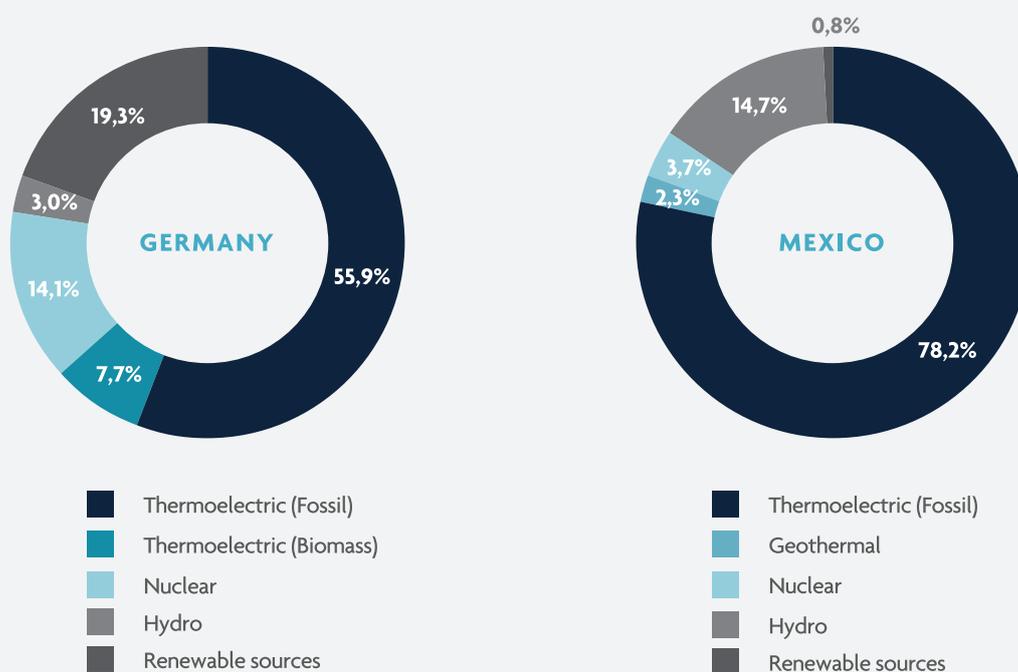
Note: *includes hydro for Germany and Mexico.

Source: Prepared with data from Ministère de l'Environnement, de l'Énergie et de la Mer - Bilan énergétique de la France pour 2014 (France); Balanço Energético Nacional 2015 (Brazil); Secretaría de Energía (SENER) - Balance Nacional de Energía 2014 (Mexico); Ministerio de Energía y Minería - Balance Energético 2014 (Argentina); Ministerio de ambiente y energía - Dirección sectorial de energía - Balance Energético Nacional de Costa Rica 2011 (Costa Rica); Ministerio de Industria, Minería y Energía - Balance Energético Nacional Preliminar 2015 (Uruguay).

ELECTRICITY MATRIX

Regarding the electricity matrix, we rearranged these same countries in two other groups. In the first one, we were grouped those countries where thermal power generation accounts for over 50% of their total electricity generation¹⁶; and another group where it accounts for less than 50% of the electricity supply. In the first group, there are Germany, Mexico, Argentina and Chile. In the other hand, France, Brazil, Uruguay and Costa Rica supply most of their electricity demand with other energy sources than those used in thermal power plants.

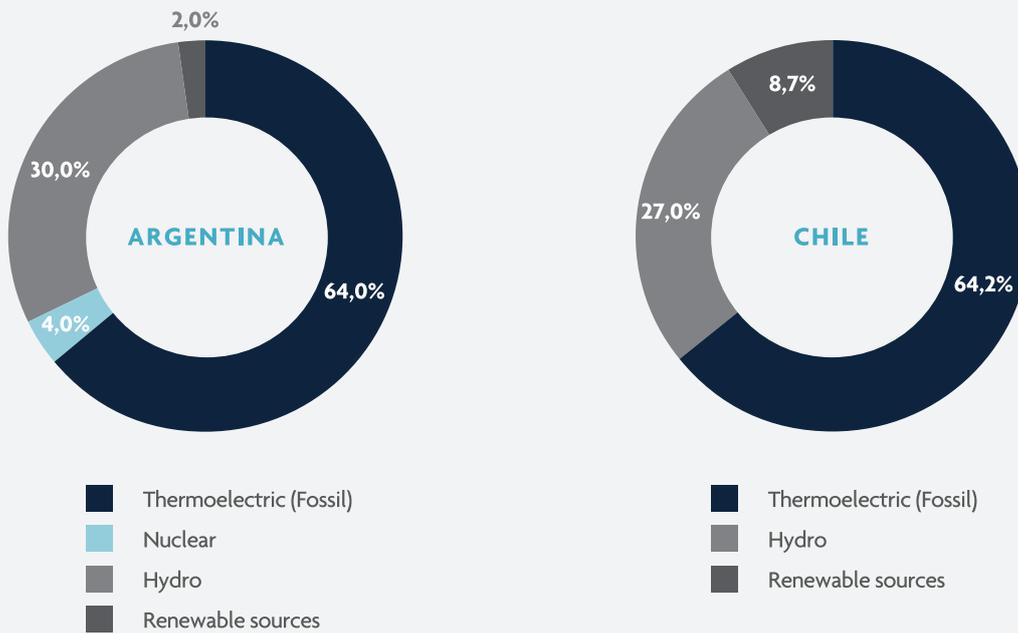
FIGURE 13 – COUNTRIES WHERE THERMAL GENERATION ACCOUNTS FOR MORE THAN 50% OF TOTAL ELECTRICITY GENERATION (CONTINUE...)



[CONTINUE](#) ►

16. Not taking into account thermal nuclear generation.

FIGURE 13 – COUNTRIES WHERE THERMAL GENERATION ACCOUNTS FOR MORE THAN 50% OF TOTAL ELECTRICITY GENERATION



Source: Prepared with data from BMWI - Federal Ministry for Economic Affairs and Energy (Germany); SENER - Sistema de Información Energética (SIE) - (Mexico); Argentina's Energy Transition: The Macri Government's Vision - Institute of the Americas (Argentina); World Bank Data - World Development Indicators (Chile).

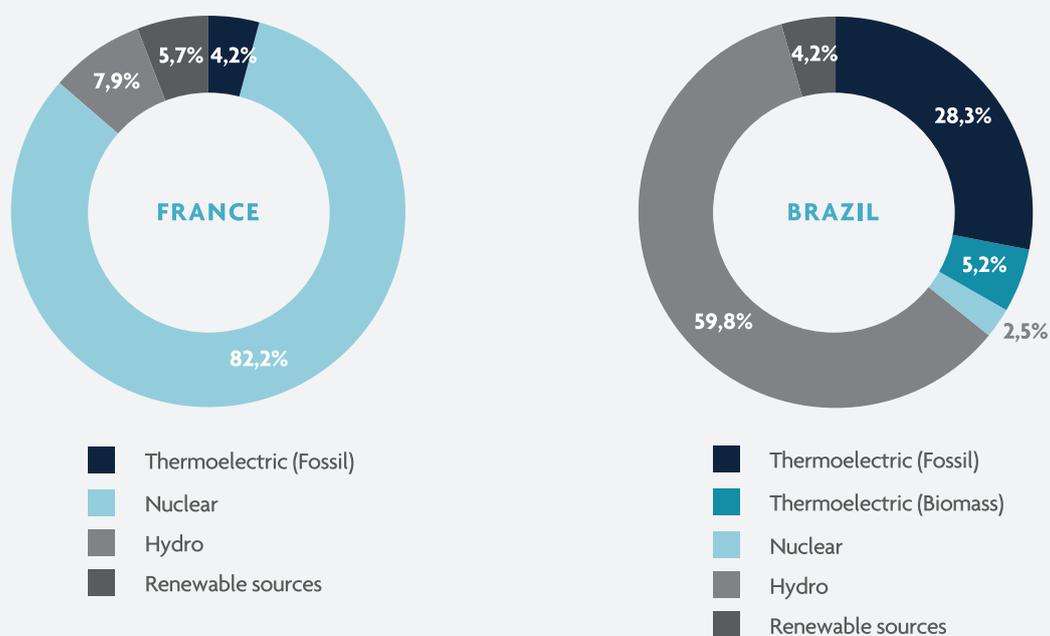
For countries where thermal power generation is predominant, the challenge is to make it as clean as possible, reducing coal generation and prioritizing natural gas generation. In particular, Chile and Germany still generate, respectively, 41% and 34% of their thermal energy from coal, while Argentina and Mexico supply most of their thermolectric plants with natural gas. Still, in order to achieve significant CO₂ emission reduction in power generation, an expansion of the share of renewables in these countries' energy matrix will be required.

Among the group that is less dependent on thermal power generation, only France does not have hydropower as its main source of electricity generation. Brazil, Uruguay and Costa Rica produce, respectively, 60%, 62% and 66% of their electricity from

hydropower resources. It is noteworthy, however, that the development of these resources can hardly be presented as a viable alternative to the expected expansion of electricity supply in developing countries, mainly due to environmental restrictions.

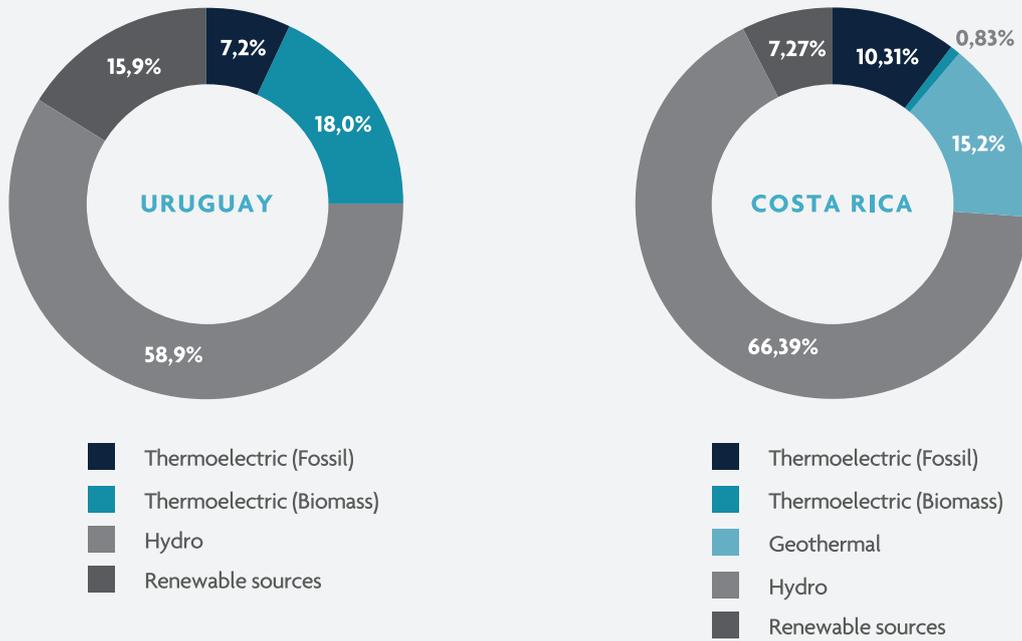
Given the restrictions of hydroelectric generation expansion, the challenge for this group of countries is to meet growing electricity demand while maintaining a clean generation profile. Currently, technological alternatives with a lower emission content are the new renewables (solar, wind, geothermal, biomass) or nuclear - each with its own challenges. The decision to expand thermal generation is another possibility, but that will result in an increase of CO₂ emissions resulting from the electricity sector in these countries.

FIGURE 14 – COUNTRIES WHERE THERMAL GENERATION ACCOUNTS FOR LESS THAN 50% OF TOTAL ELECTRICITY GENERATION (CONTINUE...)



CONTINUE ►

FIGURE 14 – COUNTRIES WHERE THERMAL GENERATION ACCOUNTS FOR LESS THAN 50% OF TOTAL ELECTRICITY GENERATION



Source: Prepared with data from EDF (France); MME - Resenha Energética Brasileira (Exercício de 2014) (Brazil); Ministerio de Industria, Minería y Energía - Balance Energético Nacional Preliminar 2015 (Uruguay); Instituto Costarricense de Electricidad (ICE) – (Costa Rica).

Despite the increased availability of various natural resources, compared to other more developed regions, such as Europe, the political and economic situation in Latin America is generally unstable. Fluctuations in international commodity prices have had a significant impact on the investment capacity of national governments in the region, whose economies are dependent on the exports of natural resources. In addition, the detachment of prudential economic policies in the last decade,

added to the fact that there is little clarity and instability of sectoral rules, have hindered foreign investments and capital attraction. Thus, the region’s energy sector has been particularly dependent on public investment.

An analysis of economic indicators in Latin America shows how the political and macroeconomic situation in the region has deteriorated, which indicates that the capacity to attract foreign investment is

essential for developing the energy sector. This way, in addition to sectoral reforms and an appropriate regulatory framework, macroeconomic

reforms - and in some cases, political reforms - are needed in order to bring stability to the region's economies.

TABLE 1 – MAIN MACROECONOMIC INDICATORS IN LATIN AMERICAN COUNTRIES – ANNUAL VARIATION (%)

	REAL GDP			INFLATION (CONSUMER)			CURRENT ACCOUNT BALANCE			UNEMPLOYMENT		
	FORECAST			FORECAST			FORECAST			FORECAST		
	2015	2016	2017	2015	2016	2017	2015	2016	2017	2015	2016	2017
NORTH AMERICA												
Mexico	2,5	2,4	2,6	2,7	2,9	3,0	-2,8	-2,6	-2,6	4,3	4,0	3,9
SOUTH AMERICA												
Brazil	-3,8	-3,8	0,0	9,0	8,7	6,1	-3,3	-2,0	-1,5	6,8	9,2	10,2
Argentina	1,2	-1,0	2,8	-	-	19,9	-2,8	-1,7	-2,2	6,5	7,8	7,4
Colombia	3,1	2,5	3,0	5,0	7,3	3,4	-6,5	-6,0	-4,3	8,9	9,8	9,4
Venezuela	-5,7	-8,0	-4,5	121,7	481,5	1.642,8	-7,6	-6,6	-2,5	7,4	17,4	20,7
Chile	2,1	1,5	2,1	4,3	4,1	3,0	-2,0	-2,1	-2,7	6,2	6,8	7,5
Peru	3,3	3,7	4,1	3,5	3,1	2,5	-4,4	-3,9	-3,3	6,0	6,0	6,0
Ecuador	0,0	-4,5	-4,3	4,0	1,6	0,2	-2,9	-2,3	-0,2	4,8	5,7	6,5
Bolivia	4,8	3,8	3,5	4,1	4,0	5,0	-6,9	-8,3	-7,1	4,0	4,0	4,0
Uruguay	1,5	1,4	2,6	8,7	9,4	8,4	-3,9	-3,9	-3,7	7,6	7,8	7,6
Paraguay	3,0	2,9	3,2	2,9	3,8	4,5	-1,8	-1,2	-1,1	6,1	6,2	6,1
CENTRAL AMERICA	4,1	4,3	4,3	1,4	2,7	3,2	-4,0	-3,9	-4,0	-	-	-
THE CARIBBEAN	4,0	3,5	3,6	2,3	4,1	4,3	-4,1	-3,4	-3,5	-	-	-
LATIN AMERICA AND THE CARIBBEAN	-0,1	-0,5	1,5	5,5	5,7	4,3	-3,6	-2,8	-2,4	-	-	-

Source: Adapted from the World Economic Outlook: Too Slow for Too Long (Abril, 2016).

The whole of Latin America and the Caribbean will show negative growth and a poor account balance performance in 2016

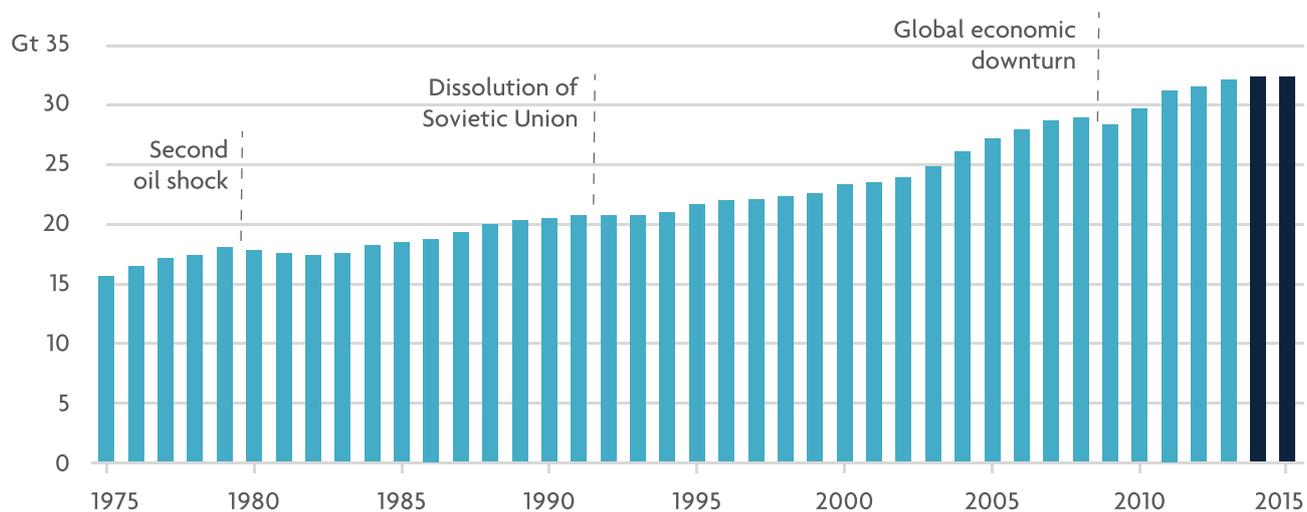
Table 1 shows some macroeconomic indicators for major countries in Latin America. The Brazilian economy, which leads in the region, showed strong deterioration in 2015, and maintains a negative outlook for 2016 and 2017. The serious situation of the Venezuelan economy, which is highly dependent on oil, affects the region. With this, the whole of Latin America and the Caribbean will show negative growth and a poor account balance performance in 2016. These prospects will be a challenge to attracting long-term foreign investment to the region.

It is important to note that the need for economic growth strongly influence the energy sector development in Latin America. Due to the urgency of the macroeconomic agenda, governments should take into account the immediate impact of investments in the energy sector on jobs and income indicators. However, the COP 21 results indicate that climate policies will tend to expand their role in the decision-making process regarding the energy sector, and that energy planning should incorporate such policies. Thus, investments in clean energy technologies will grow in importance due to the need to limit the increase in emissions, despite the region's current relatively clean energy mix and the abundance of natural resources.

Thus, Latin America should be able to balance the short-term potential earnings from developing fossil resources with the long-term benefits of investing in cleaner energy. Regardless, the attraction of investments and international expertise will be essential – whether to overcome structural gaps in infrastructure and develop fossil resources, or to invest in clean energy technologies and develop the new infrastructure needed for its adoption.

Therefore, although the economic agenda of developing countries has focused primarily on growing their economies, this growth does not need to be associated with increased CO₂ emissions. Recent data released by the IEA show that the volume of global CO₂ emissions has remained stable since 2013, although the global economy has grown 2.6% in 2014 and 2.4% in 2015¹⁷ (estimate). These data were mainly influenced by the decrease in emissions from the United States and China. The evidence that economic growth can be decoupled from increasing emissions is very promising news for Latin America because it shows that it is possible to combine economic growth with energy transition to a low carbon matrix.

17. World Bank: <http://www.worldbank.org/en/publication/global-economic-prospects>

FIGURE 15 – GLOBAL ENERGY-RELATED CO₂ EMISSIONS

IEA analysis for 2015 shows renewables surged, led by wind, and improvements in energy efficiency were key to keeping emissions flat for a second year in a row.

Source: International Energy Agency (IEA). *Decoupling of global emissions and economic growth confirmed*, 2016.



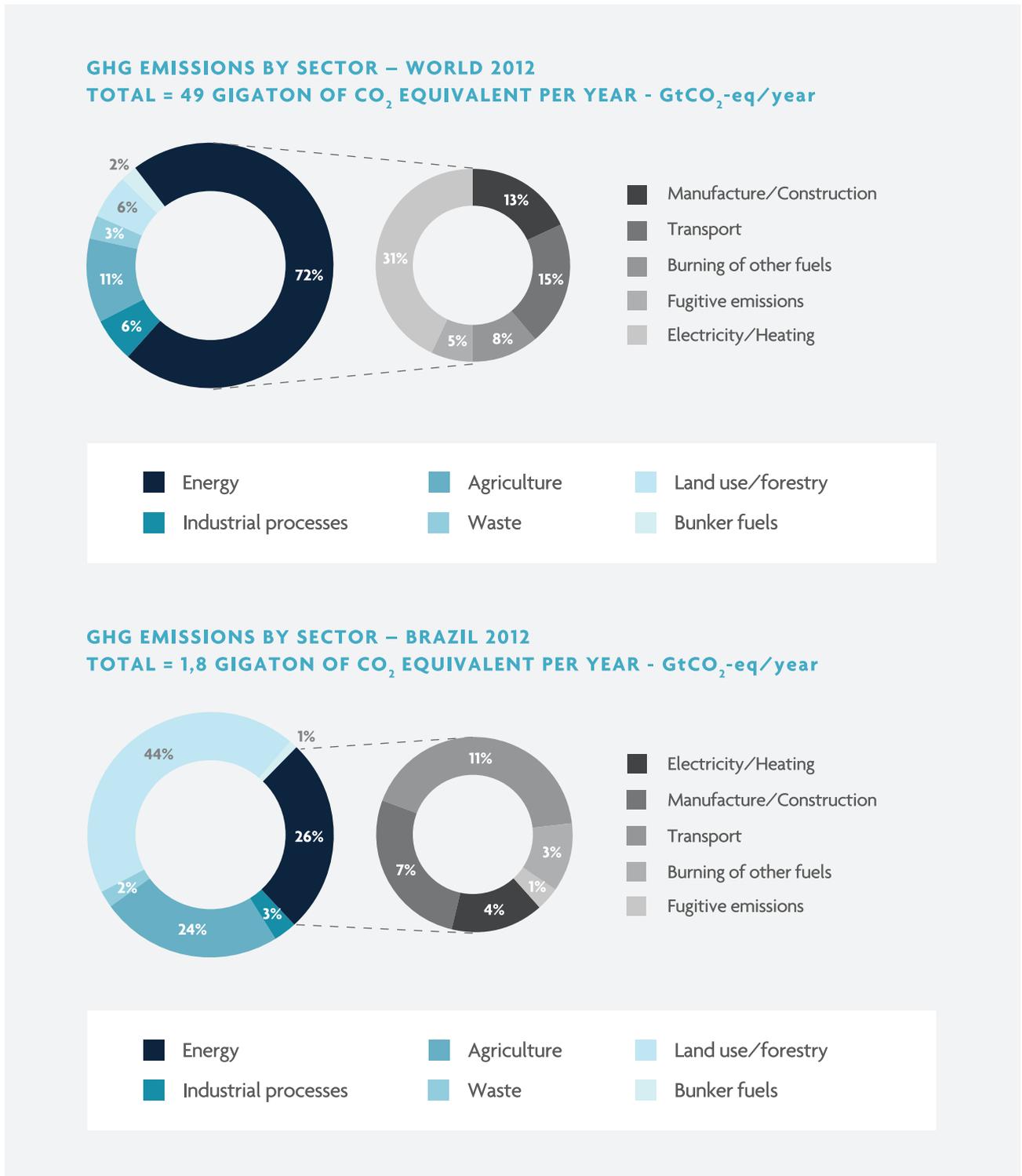
Energy transition in Latin America - Initiatives and challenges

As shown in the previous chapter, when we compare Latin America and Europe, we understand that the energy transitions in these two regions are at very different levels. Despite the obvious differences between the two blocs, there are also intra-regional differences; Latin America is an example of this assumption, particularly in relation to the energy and environmental profile of countries. For example, Brazil is a country with absolute GHG emissions that are similar to those of most advanced economies, which makes it difficult to draw a parallel with other countries in the region. It is no coincidence that in many forums on climate, Brazil creates coalitions with countries outside Latin America, such as the BRICs, due to greater identification with these countries' agenda.

Another example of intra-regional differences is observed in countries' GHG emissions profile. When comparing with Argentina and Mexico, Brazil's emissions profile has been atypical, with the "Land Use and Forestry" sector being the country's major greenhouse gas emitter in 2012. "Agriculture" and "Electricity and Heating" are the major GHG emitters in Argentina and Mexico,

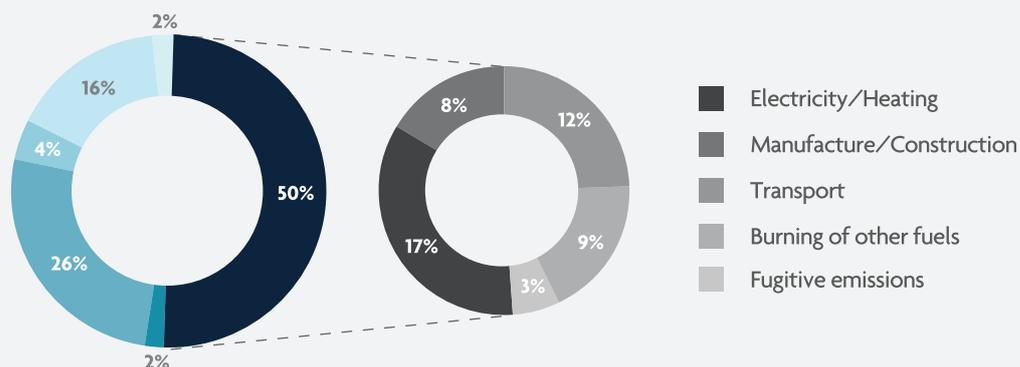
respectively. Mexico's emissions profile, in turn, follows the world's pattern. Therefore, we can say that Brazil is isolated when it comes to its emission profile in Latin America, which contributes to its low level of integration with other countries in the region during climate talks and the development of energy transition policies.

FIGURE 16 – GHG EMISSIONS BY SECTOR: WORLD, BRAZIL, ARGENTINA, AND MEXICO*



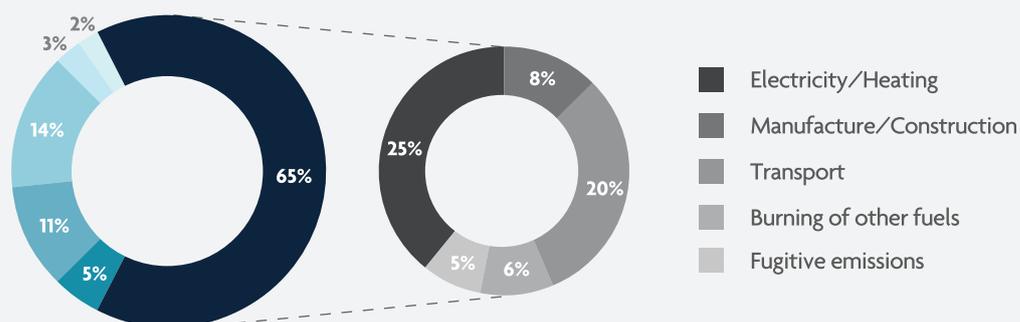
GHG EMISSIONS BY SECTOR – ARGENTINA 2012

TOTAL = 0,4 GIGATON OF CO₂ EQUIVALENT PER YEAR - GtCO₂-eq/year



GHG EMISSIONS BY SECTOR – MEXICO 2012

TOTAL = 0,8 GIGATON OF CO₂ EQUIVALENT PER YEAR - GtCO₂-eq/year



*NOTES (PRESENTED VALUES WERE ROUNDED).

INDUSTRIAL PROCESSES	Emission of: <ul style="list-style-type: none"> - CO₂ from cement processing - N₂O from the production of adipic and nitric acids - N₂O e CH₄ from other industrial processes (except agriculture) - F-gases: HFCs, PFCs, and SF6
AGRICULTURE	Emission of: <ul style="list-style-type: none"> - CH₄ from enteric fermentation (Livestock) - CH₄ and N₂O from manure management - CH₄ from rice cultivation - N₂O from agricultural soils: <ul style="list-style-type: none"> Synthetic fertilizers Manure applied to the soil Manure applied to pasture Crop residues Growth on organic soils - CH₄ e N₂O from other agricultural sources <ul style="list-style-type: none"> Burning of crop residues Burning of savannah
WASTE	Emission of: <ul style="list-style-type: none"> - CH₄ from landfills (solid waste) - CH₄ from wastewater treatment - N₂O from human sewage - CH₄ e N₂O from other waste
LAND USE/ FORESTRY	Emission from burning of: <ul style="list-style-type: none"> - Forest lands (CO₂, CH₄, N₂O) - Crop lands (CO₂) - Pastures (CO₂) - Biomass (CO₂, CH₄, N₂O)
BUNKER FUELS	Emission of CO ₂ from the following activities <ul style="list-style-type: none"> International air bunker fuels (transportation) International marine bunker fuels (transportation)
ENERGY: INDUSTRIAL AND CONSTRUCTION SECTORS	Emission of CO ₂ from the burning of fossil fuels in the following activities: <ul style="list-style-type: none"> - Iron and steel - Chemical and Petrochemical products - Non-ferrous metals - Non-metallic minerals - Transportation equipment - Machinery - Mining and mineral extraction - Food and tobacco - Paper, pulp and printing - Wood and wood products - Construction - Textile and leather - Unspecified industries - Industries non-intensive in energy/ Transformation/Energy

ENERGY: TRANSPORTS	Emission of CO ₂ from the burning of fossil fuels in the following transport activities: <ul style="list-style-type: none"> - Domestic aviation (commercial, private, agricultural, military, etc.) - Road - Rail - Pipeline - Inland navigation - Non-specified transportation means - Non-energy use in the transport sector
ENERGY: BURNING OF OTHER FUELS	Emission of CO ₂ , CH ₄ , e N ₂ O from the following activities: <ul style="list-style-type: none"> - CH₄ and N₂O from burning of biomass - CH₄ and N₂O from stationary and mobile sources - CO₂ from other sectors
ENERGY: FUGITIVE EMISSIONS	Emission of CO ₂ , CH ₄ e N ₂ O: <ul style="list-style-type: none"> - CO₂ from natural gas burning/ventilation - CH₄ from natural gas and oils systems - CH₄ from coal extraction - CH₄ and N₂O from other energy sources (Natural Gas fugitives, Oil and Solid fuels)
ENERGY: ELECTRICITY AND HEATING	Emission of CO ₂ from: <ul style="list-style-type: none"> - Production of electricity and heating - Electricity compounders Unallocated - Other uses within the energy industry

Source: World Resources Institute (WRI). CAIT Climate Data Explorer: Historical Emissions, 2012.

Given these differences, this chapter will focus on the mitigation efforts of Latin American countries towards the development of a cleaner energy mix. Due to each country's idiosyncrasies, a group of countries will be discussed in more details: Argentina, Brazil and Mexico. First, the goals set up by each country in its iNDC (intended Nationally Determined Contribution) during COP 21 will be presented. Then, the existing initiatives that contribute to reach the agreed targets will be listed. Finally, the challenges that each country faces in this process will be presented.

Given the different starting points, due to the countries' different energy mixes, it is important to understand how they are preparing, through these intentions and initiatives, to reach their GHG emission targets in the future. It is noteworthy that, in addition to the aforementioned, the regulatory framework and economic and financial incentives in each country are important in determining the pace of their actions towards a low carbon economy.

iNDC

As mentioned, Brazil is a country with very unique characteristics when compared to its Latin American neighbors. First of all, it has a vast territory and particular issues regarding land use (opening of new agricultural frontiers) associated with deforestation, the size of the agricultural sector and its energy structure. The combination of these factors places Brazil's GHG emissions at levels similar to those of developed countries. With regard to its energy mix, passengers and cargo are transported mostly by road through the use of fossil fuels.

Despite being a large CO₂ emitter, Brazil possesses an electricity matrix essentially clean and has maintained this characteristic over time. The Ministry of the Environment dictates the country's environmental agenda (MMA, in its Portuguese acronym), which was responsible for drafting the Brazilian iNDC. The main goal presented was the intention to reduce by 43% the emission levels by 2030, reaching 1.2 GtCO₂ (GWP-100; IPCC AR5) in relation to the 2.1 GtCO₂ emitted in 2005. The country has also set up interim emission and efficiency targets, as reaching 2 GtCO₂ gross emissions in 2020 and reducing by 75% the GHG emissions per unit of GDP by 2030 (compared to 2015). One of the ways by which Brazil intends to achieve its goals is through increasing the use of renewable energy from 28% to 33% by 2030, in addition to its hydropower use.

As for Argentina, among the goals set by its iNDC we can highlight: the intention of reducing unconditionally by 15% its GHG emissions by 2030, compared to projections of the *Business as Usual*

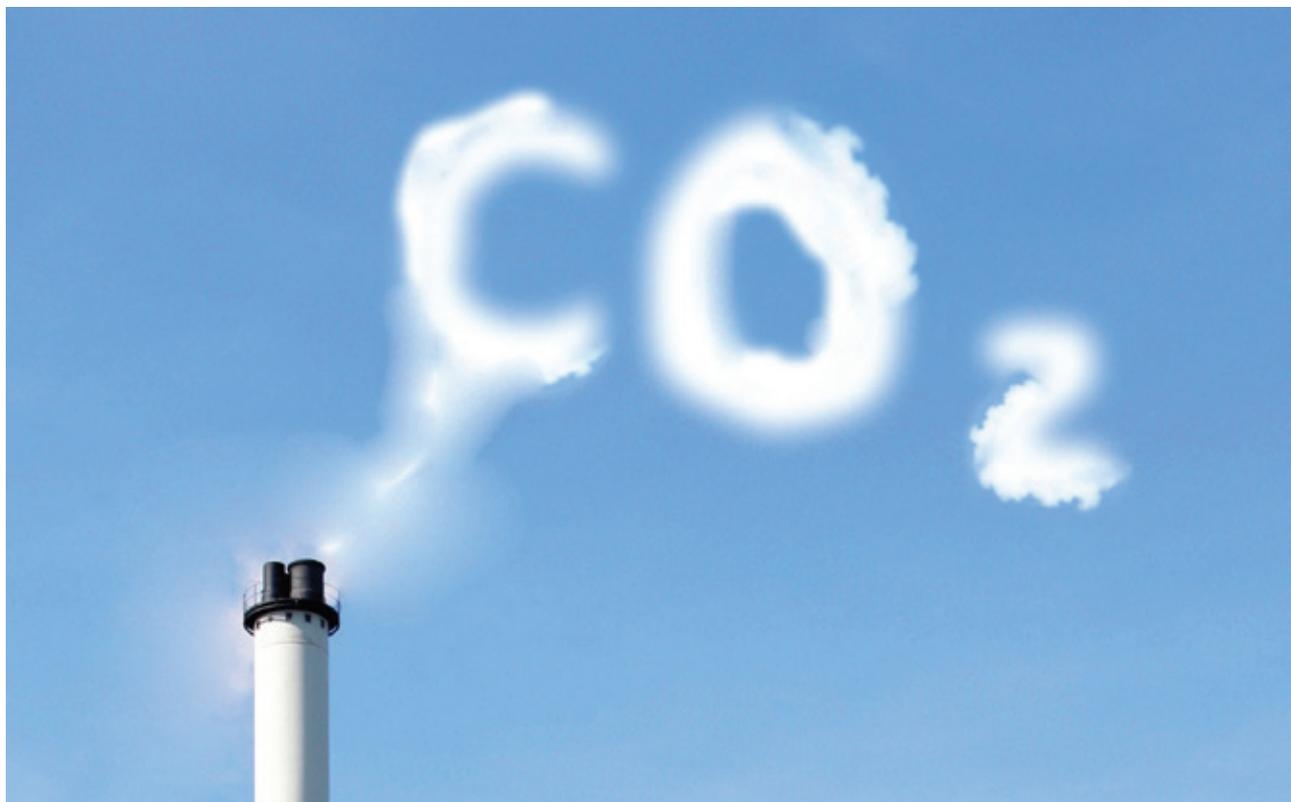
*Scenario*¹⁸ (BAU) for that year; and, conditionally - with adequate and predictable international financing - by 30%; support for transfer, innovation and technological development; and support for capacity building. The country also signaled that it will pursue the diversification of its energy sources and the promotion of rational and efficient energy use and more actions linked to the energy transition context. Argentina's goals are very general and dwell in the realm of intentions, with little specification for the composition of its matrix in the long run.

In addition to most of the iNDC main goals, there is also a lot of criticism about how the document was prepared. The Argentine proposal is not the result of a solid plan based on an institutional program, but it was designed by one consultant, who was responsible for this request. There is much speculation about Argentina reviewing its iNDC, but through the same process by which it was prepared, that is, by one consultant. Critics also indicate the lack of a technical debate on the country's proposals, which was reflected in a document that did not include climate policy, specific projects and ambition.

Regarding Mexico, its restricted planning in the environmental area was portrayed in the proposals made by the country at COP 21. In its iNDC, the country has set an unconditional reduction target of 25% of its greenhouse gas emissions and other short-lived polluting gases by 2030, considering BAU's projection¹⁹. Despite this overall goal, there are no targets to increase the share of renewable energy in its energy matrix or in its electricity mix.

18. Reference scenario designed from a projection of economic growth in the absence of climate change mitigation policies.

19. This goal may be increased to a 40% reduction, but it is subject to a global agreement that addresses important topics such as carbon pricing, technical cooperation, access to technology and financial resources at low costs, and all these conditions measured in face of the global challenge of climate change.



Mexico also has unique features when compared to its Latin American neighbors. The country's economy is very connected to the US economy and this relationship spills over into its political and structural aspects, including those related to its climate agenda. For example, power transmission lines and gas pipelines are well linked between the two countries. Although there is strong economic and political connection, Mexico does not have an environmental agenda as developed as that of its Northern neighbors. Unlike the US and Canada, which have associated energy and climate plans, Mexico does not have an advanced environmental planning, which was reflected in its commitments made at COP 21.

EXISTING INITIATIVES:

BRAZIL

In recent years, Brazil has been increasingly investing in renewable energy and energy efficiency. The table below lists some of the major initiatives that have potential to contribute to the achievement of the goals agreed by the country at COP 21 and to the evolution of a national agenda for energy transition.

LEGISLATION/ REGULATION	PROGRAMS/ INITIATIVES	NATIONAL FUNDING	TAX ADVANTAGES	MULTILATERAL FUNDING
Energy Efficiency Law (n. 10.295) of 2001: along with the Procel (National Program for Energy Conservation), it includes several initiatives to promote energy efficiency in the country (with consumers, buildings and industries).	PROINFA ²⁰ : program that promote alternative energy sources, which particularly propelled wind power	BNDES: <ul style="list-style-type: none"> • Finem²¹: supports renewable and alternative energy sources • Climate Fund²²: projects to mitigate climate change 	<ul style="list-style-type: none"> • Tax exemption for mini and micro distributed power generation at the federal level (PIS / PASEP and COFINS) and state level (ICMS, in selected states²³) 	IDB: extensive list of funding for environmental projects in Brazil. Many of them include promoting the use of clean energy ²⁴
Normative Resolution by ANEEL 482/2012: establishes the general conditions for access to distributed micro and mini generation	Regular schedule of electricity generation auctions, differentiated by source, in order to promote the use of alternative sources	Inova Energia: initiative for the joint coordination of development actions and funding from FINEP ²⁵ , ANEEL and BNDES	Several other incentives in state level (Example: in the state of Pernambuco, wind power generation equipment get a 75% reduction in the income tax and ICMS ²⁶ exemption)	IFC (World Bank): Funding for energy efficiency projects

CONTINUE ►

20. The program provides for the implementation of 144 plants, totaling 3,299.40 MW of installed capacity, with 1,191.24 MW from 63 power plants, 1422.92 MW of 54 wind power plants, and 685.24 MW from 27 power plants from biomass.

21. More than R\$20 million to finance projects that aim to implement, expand and modernize enterprises, including support for wind, solar, small hydro and other alternative energies.

22. Support for projects or studies and financing of projects in renewable energy and efficient transport modes.

23. <http://www.greenpeace.org/brasil/pt/O-que-fazemos/Clima-e-Energia/energia-solar/icms/>

24. The "Taua Solar Photovoltaic Pilot Project" was recently launched. It is the first electricity generation project in Brazil that connected the photovoltaic generation system to the National Integrated System - SIN (transmission system).

25. Studies and Projects Funding Agency.

26. <http://investimentos.mdic.gov.br/public/arquivo/arq1348852119.pdf>

LEGISLATION/ REGULATION	PROGRAMS/ INITIATIVES	NATIONAL FUNDING	TAX ADVANTAGES	MULTILATERAL FUNDING
	ProGD: program to promote distributed generation	FNE Sol – Banco do Nordeste (BNB): incentives to Solar power production in the Brazilian Northeast		“Basel Agency for Sustainable Energy” (BASE): programs to support the use of renewable energy
				“IEA Technology Cooperation Program”: programs to support the use of renewable energy

ARGENTINA

In Argentina, the Renewable Energy Development Fund appears as the main funding mechanism for renewable energy projects in the country. In addition, several energy efficiency programs are

developed, as well as investment in nuclear, solar and biomass power. The table below lists these key initiatives.

LEGISLATION/ REGULATION	PROGRAMS/ INITIATIVES	NATIONAL FUNDING	TAX ADVANTAGES	MULTILATERAL FUNDING
Law 27.191/2015: It creates intermediate ²⁷ goals for the participation of renewable energy in the Argentine energy matrix and stipulates conditions for the creation of the Renewable Energy Development Fund	Energy efficiency promotion programs: <ul style="list-style-type: none"> • Energy Efficiency Program (GEF, in Spanish); • Labeling and Energy Efficiency Program; • National Program for the Rational and Efficient Use of Energy (PRONUREE); • Program for the Rational and Efficient Use of Energy in Public Buildings (PROUREE) 	Renewable Energy Development Fund ²⁸ : created by Law 27.191/2015		

27. 8% in 2017, 12% in 2019, 16% in 2021, 18% in 2023 and 20% in 2025.

28. Fondo del Desarrollo de Energías Renovables – FODER.

LEGISLATION/ REGULATION	PROGRAMS/ INITIATIVES	NATIONAL FUNDING	TAX ADVANTAGES	MULTILATERAL FUNDING
	Incentives to generate nuclear energy: intended to double its share in the electric matrix (from 2.5% today to 5.6% in 2025) ²⁹			
	Project IRESUD: promotes the installation of photovoltaic systems (low voltage)			
	PERMER: Project for Renewable Energy in Rural Markets			
	PROBIOMASA: Increase the production of electricity and thermal energy from biomass			

MEXICO

Mexico is currently implementing an energy reform that could potentially transform the industry (more details in the next section). Listed below are the Mexican initiatives to prepare for climate change and promote energy transition.

²⁹. Institute of the Americas. *Argentina's Energy Transition: The Macri Government's Vision*. Report, 2016.

LEGISLATION/ REGULATION	PROGRAMS/ INITIATIVES	NATIONAL FUNDING	TAX ADVANTAGES	MULTILATERAL FUNDING
General Law on Climate Change (2012): establishes guidelines to address the climate change adverse effects	Renewable energy auctions	Climate Change Fund (FMC): Created by the General Law on Climate Change (2012)		Proyecto de Eficiencia y Sustentabilidad Energética en Municipios (PRESEM): with support from IDB, it supports energy efficiency investment in municipalities
Energy Transition Law (2015): along with the previous law, it stipulates a target of 35% of clean energy in the energy matrix by 2024; it creates the <i>Renewable Portfolio Standard</i> (quotas and clean energy certificates); provides intermediate targets for achieving the overall goal	PRONASE (National Program for Sustainable Energy Use): it aims to ensure appropriate use of energy in all its processes and activities, from exploration to final consumption			Other projects supporting renewable energy and distributed generation, energy access, energy efficiency, smart meters, geothermal energy, among others ³⁰
Ley de Promoción y Desarrollo de los Bioenergéticos (2008): it establishes guidelines for bioenergy development	Programa de Desarrollo del Sistema Eléctrico Nacional 2016-2030 (PRODESEN): it seeks to diversify and promote the efficiency of the energy matrix and plan the necessary infrastructure to meet the demand for electricity			
Geothermal Energy Law (2014): it aims to regulate recognition, exploration and exploitation of geothermal resources	Programa de Redes Eléctricas Inteligentes: it aims to modernize national transmission and distribution networks in order to support the development of distributed and renewable generation.			

30. Inter-American Development Bank (IADB). *Energy Database: Projects: Mexico*.

ENERGY TRANSITION CHALLENGES

All the countries considered here have common and unique characteristics that may pose challenges to the energy transition. These challenges are discussed below.

BRAZIL

In Brazil, in addition to the laws and programs listed in the table above, there are several other initiatives that come across the country's structural issues. First, plans for the Brazilian electro-energy expansion do not have targets. Instead, they have projections for a possible composition of the country's energy matrix in the long run. Therefore, the energy planner is not objective regarding how to reach the iNDC goals.

Moreover, due to the issue's scope, which encompasses the energy and environment sectors, there should exist better organization and dialogue between the various economic agents involved. Communication between the main planners for the energy transition agenda, however, is not efficient. These planners are the MMA and the Ministry of Mines and Energy (MME) - and consequently between their regulatory agencies (IBAMA, ANP and ANEEL). Moreover, inside the MME, programs are not structured to be complementary through central coordination, being actually the energy planner's isolated attempts to fulfill demands already initiated through spontaneous processes.

In addition, various mechanisms of planning, development and financing for electricity via alternative and cleaner sources, though incipient, have no parallel in the transport sector. As mentioned, the extensive use of fossil fuels in the transport sector is a major source of greenhouse gases generation in the country. This fact contradicts the Brazilian leadership regarding the development of biofuel technology, as Brazil is the only country that produces cars with full flex engines (interchangeable use between gasoline and ethanol).

In the mid-2000s, with the discovery of the pre-salt layer, the government's resources and attention focused on the potential of oil and its by-products production in the region. Investments and attractiveness for less polluting liquid fuels were put aside, which delayed the country's biofuel development agenda. Today, Brazil already has 2nd generation³¹ ethanol production technology, and the development of 3rd generation³² ethanol is in its pipeline. But the economic attractiveness of this fuel is concentrated near the producing regions, for logistical issues that increase the final product's price for remote regions.

One can affirm that there is a lack of engagement and public planning to promote the use of ethanol. Moreover, this lack of planning is correlated with the transport sector's deficit as a whole. The transport sector has a small rail network and uses very little of its coastal shipping potential. Even if these other modes use fossil fuels, the transportation efficiency would be much higher.

31. *Generated from the co-products of sugarcane (bagasse and straw) used in the traditional process of ethanol and sugar production.*

32. *Derived from microalgae.*

As for Argentina, even with some ambitious proposals in its iNDC, the possibility of achieving them is questioned because of expectations raised by the new government, whose main goal is that the country returns to a situation of solid economic growth

Brazil is one of the leading countries in the climate agenda worldwide. The success of its electricity generation model via hydroelectric plants connected by the SIN in the 70s, the pioneer development of biofuels and flex cars, and its endowment of natural resources place the country as one of the leaders in the energy transition debate. In the short term, it is likely that the country meets its iNDC goals because its economic activity has been presenting a strong slowdown. However, planning for energy transition is done for the long run, and in this regard Brazil is not showing consistency.

ARGENTINA

As for Argentina, even with some ambitious proposals in its iNDC, the possibility of achieving them is questioned because of expectations raised by the new government, whose main goal is that the country returns to a situation of solid economic

growth. Therefore, the search for economic and social stability is overshadowing other agendas, such as energy, which is made clear by the lack of a structured planning for the sector. In February 2016, when the new government completed one hundred days, intentions were announced for the energy sector, which included greater use of renewable energy (increasing its share from 6.6% today to 14.6% in 2025) and decreased use of fossil energy (reduce the use of oil from 32.6% today to 23.7% in 2025, and of natural gas from 51.1% to 49.6%)³³. However, these intentions have not yet been formalized, showing the weakness of the Argentine energy plan.

Playing against the achievement of the iNDC goals is the underinvestment in the electricity sector. The annual investment in the energy sector from 2003 to 2012 was on average 550 MW³⁴. This number is only half of the 1000 MW annual investment target for renewable energy needed to achieve 10 GW

³³. Institute of the Americas. *Argentina's Energy Transition: The Macri Government's Vision*. Report, 2016.

³⁴. Average calculated using the data obtained on the following site: <http://www.energia.gob.ar/contenidos/verpagina.php?idpagina=3881> (*Energías Renovables – Nuevo Marco Regulatorio y Perspectivas 2016*).



installed in 2025³⁵. In mid-December 2015, the government declared a state of emergency in the electricity sector, which is planned to last until the end of 2017. Clearly, there are short-term obstacles to a solid planning toward the transition to a cleaner energy matrix.

Another obstacle to Argentina's goals is its energy structure and allocation of natural resources, which are based on fossil materials. Even considering only its energy matrix in 2013³⁶, approximately 64% of the electricity generated was coming from fossil fuel. It is, therefore, necessary to engender great effort in planning and investment to change

this situation. In addition, the gas dependence can become even greater when the geological potential of unconventional natural gas reserves, such as *Vaca Muerta*, come into full development.

Initiatives in the transport sector are not in the same development stage as those made in the electricity sector. Despite being the third largest GHG emitter in Argentina (around 12%), the transport sector has no mitigation targets, neither through increased efficiency of its network, nor through changes in the fuels used. There is no coordination between the energy industry planners and the environment planners.

35. Average calculated using the data obtained on site: <http://www.energia.gob.ar/contenidos/verpagina.php?idpagina=3140> (Installed capacity 1976-2012).

36. Institute of the Americas. *Argentina's Energy Transition: The Macri Government's Vision. Report, 2016.*

In short, institutional, governance, and macro-economic barriers make it difficult to establish the environmental agenda as paramount in the country, in particular regarding energy transition. The improvement in these areas, and mainly the planning capacity, are mandatory to achieve the GHG emission targets proposed by the country. As for the operational aspect, investments in the energy sector, the practice of competitive prices and changes in the regulatory framework need to take place so that there is in fact a more elaborate policy in the energy sector, focusing on increasing the use of renewables.

MEXICO

With regard to Mexico, part of its lack of ambition in the environmental sector is due to a lack of appeal for this agenda. First, it is important to note that the country is going through a deep energy reform with a strong focus on the oil and gas sectors, with the future of the Mexican energy market being drawn through the current regulatory changes. The Mexican agenda for the industry is counting on a pro-market solution – as it tries to create a stable and predictable political and regulatory environment to attract private investment to the sector with little government initiative, especially from the perspective of financing and promotion. Although *Petróleos Mexicanos* (Pemex) and the *Comisión Federal de Electricidad* (CFE) continue to play important roles, there will be much government disinvestment in the sector since it is not focusing on environmental issues at this time.

Moreover, the environmental agenda is regarded as a matter of international relations, having little integration with domestic planning bodies. Finally, the government is not consistent regarding clean

energy in Mexico. In many opportunities, the official position is that there is no need to worry about renewables - a view supported by the official definition of clean energy, which comprises renewable sources, hydropower, nuclear energy, high efficiency cogeneration process and natural gas.

The inclusion of natural gas among clean fuels raises questions from environmentalists, but this fuel's participation in the economy is substantial (about 45% of the energy matrix). Natural gas is important for Mexico because of two factors: a significant reduction of GHG emissions in the electricity sector caused by the replacement of thermal oil by gas; and the international environmental debate, pointing to gas as the energy source for the transition to a cleaner matrix since it pollutes less than oil and its by-products.

Government revenues from Exploration and Production (E&P) of oil and gas, the low cost of gas coming from Texas, in the USA, and the industries' lobby, advocating its use as an energy source, also diminish the appeal of the inclusion of renewable energy in the Mexican energy matrix. This reduces the urgency of the discussion and planning of a wide and structured environmental agenda in the country.

The transport sector is another area not widely covered in the energy planning and one of the main sectors to suffer from the lack of environmental planning. Similar to other Latin American countries, in Mexico the transport sector is the 2nd largest GHG emitter (about 20%)³⁷, contributing to the pollution of urban centers. Today, Mexico City has a serious air pollution problem. Nevertheless, the Mexican energy reform did not consider energy transition in this sector. As a result, transition

37. The sector that emits the most is electricity, with 25% of the emissions, while the waste sector accounts for 14%.

planning for the current transport system to a more efficient one, particularly from the energy point of view, was not carried out, which led to the sector not being considered for public funding.

Likewise, topics such as electrification of transport, through the connection between cities by electric trains, are not discussed, because they are not appealing due to the high cost of these projects. Nevertheless, in a low oil price environment – which led the government to reduce tax revenues from oil E&P and makes it economically competitive with other energy sources - it is inevitable that the discussion on clean energy for transport is left aside. On the other hand, discussions focus on how to “gasify” this sector.

Despite the availability and low price of gas, changing the entire infrastructure to meet vehicle’s gas demand takes a long time and, even if planning is taken to the letter, the country also needs to consider its US dependence. There was a considerable increase in the share of US imports in the total consumption of gas. In 15 years, the share increased from 5% to 25%, meaning that in 2013 one quarter of the gas consumed in Mexico was imported from the US³⁸.

It is also important to remember that the laws and programs listed in the table above do not include the transportation sector in their goals and, although the Mexican iNDC targets are not considered ambitious, as they are restricted to the electricity sector, they represent a major evolution for the country, since the incorporation of renewable energy in the Mexican energy matrix was not part of its goals.

An external factor that can benefit Mexico is California’s energy transition agenda. The American state has ambitious targets: 33% of renewable energy eligible portfolio by 2020 (22.7% was completed by 2014³⁹). Hence, California can come to demand a lot of energy generated in Mexican territory, which has the potential to attract investments in renewable energy in Mexico in the coming years.

Another positive factor for the country is its wind potential, which is very favorable to the development of this type of energy generation, with a potential of over 10,000 MW of wind resources⁴⁰. The U.S. Energy Information Agency (EIA) predicts Mexico will become a major producer of wind power, with rapid growth in the coming years.

38. *Elaborated based on data from the US. Energy Information Administration (EIA).*

39. *Nance, Peter. 2014.*

40. *Ibid*

URUGUAY - A CASE OF SUCCESS

Among the Latin American countries analyzed, the energy transition in Uruguay is at a more advanced stage. This success is due to: a wide availability of clean natural resources⁴¹, a strong institutional and macroeconomic environment, well-structured legal and regulatory processes, and robust public companies, with will to work in partnership with private enterprises. These factors have created a very favorable environment for the attraction of private capital investments, particularly from foreign countries, culminating in the incorporation of a new successful business model for the energy sector.

According to Ramón Méndez⁴², National Energy Director of Uruguay, understanding that the renewable industry is just another finance business has contributed to the success of the country's energy policies. According to him, since operation and maintenance (O&M) costs are not high and there is a safe environment for the investor, projects become attractive. For example, there are projects in which the government guarantees a fixed price for the sale of electricity over 20 years, and as the O&M costs of renewables are low, the profit for the investor is ensured.

In addition, approval and implementation of the "Energy Policy 2005-2030" plan, which designed the Uruguayan strategy to achieve its long-term energy goals, are evidence that well-structured planning contributes significantly to the realization of a successful energy transition policy. For the country, the plan's goals should be combined with other development fronts, such as increased industrial competitiveness, economic and environmental sustainability, and social integration.

The plan created three lines of action: institutional, supply of electricity, and electricity demand. On the institutional front, incentives for research funding and promotion, development and innovation in energy issues were established. On the supply side, the government aimed to boost investment in energy projects that do not require subsidies⁴³. As for the actions on the demand front, the creation of appropriate

41. *Good wind conditions, sunlight and great amount of biomass resulting from agriculture. Energías renovables, 2014 (Uruguay XXI, 2014).*

42. *The Guardian. Uruguay makes dramatic shift to nearly 95% electricity from clean energy, 2015.*

43. *Such as medium and large size wind farms, biomass, solar thermal, using certain residues, small scale hydropower and certain bio-fuels.*

financial mechanisms to promote technological changes and processes - both at the residential and industrial levels - which would improve energy use efficiency, were pursued.

Similarly to the legal aspect, the regulatory framework is one of the main drivers in expanding renewables use in Uruguay. A large number of legal instruments regulate the drive for energy efficiency and renewable energy, mainly by defining ways to invest. Moreover, these instruments have had a disciplinary role, by mandating that the public sector use renewable energy.

Moreover, solar energy is strongly endorsed through photovoltaic generation, and particularly through solar thermal energy. Law number 18,585/09, known as the Solar Thermal Energy Promotion law, established development and training in solar thermal energy use as a national interest. The law also established a minimum percentage (20%, which was subsequently raised to 50%) for solar energy use for water heating in health centers, hotels, clubs and public buildings.

As a result of this comprehensive incentive policy, renewables currently account for about 93%⁴⁴ of Uruguay's electricity matrix and for about 57%⁴⁵ of its energy matrix, if biofuels used in transport are taken into consideration. Therefore, it is noted that in recent years Uruguay has already been living an energy transition towards a cleaner matrix. Consequently, in 2012, the country ranked first among those that invested in renewables per unit of GDP. In addition, in November 2014, WWF⁴⁶ elected Uruguay⁴⁷ as the second green energy leader (renewable and clean) in Latin America.

Given the existence of a successful energy policy focused on energy efficiency and promotion of renewable energy, Uruguay was considered a successful study case at COP 21⁴⁸. Its unconditional⁴⁹ goal of reducing emissions of greenhouse gases, established in its INDC, predicts an emission intensity reduction of 25% per unit of GDP by 2030 in the energy sector, based on 1990 values, and the maintenance of emissions

44. *Balance Energetico Nacional Preliminar de Uruguay 2015 (BEN Preliminar, 2015).*

45. *Balance Energetico Nacional Preliminar de Uruguay 2015 (BEN Preliminar, 2015).* The global average in 2012 is 18%. (*World DataBank*).

46. *Together with Costa Rica (1°), Brazil (3°), Chile (4°) and Mexico (5°).*

47. *World Wide Fund for Nature (WWF), 2014.*

48. *The Guardian. Uruguay makes dramatic shift to nearly 95% electricity from clean energy, 2015.*

49. *To be achieved only with domestic resources.*

below 40 gCO₂/kWh⁵⁰. Although these targets seem ambitious, the country is already in a prominent position on its energy transition agenda, especially in the electricity sector.

A differential of the Uruguayan iNDC was the concern for their transport sector. The main guidelines are: increase the percentage of a mixture of biofuels in petrol and diesel; the introduction of public and private hybrid vehicles - mainly using higher percentages of mixtures with biofuels; and the improvement of freight transportation through the incorporation of new multimodal systems and increased use of rail and internal waterways.

In short, Uruguay is an example of how economic, political and institutional stability, as well as performing a simple but comprehensive planning are key factors to the success of renewable energy and an energy transition policy. It is important to make clear, however, that Uruguay is a small country, with less diversity and economic and political complexity when compared to other major regional Latin American countries like Argentina and Brazil. Moreover, from a technical point of view, the electrical integration of the country is less complicated and, therefore, contributed to achieve 100% electrification in the country and the wide diffusion of renewable energies.

⁵⁰. *Targets conditioned to the availability of external resources.*



Public Engagement in Energy Transition

Although climate change affect the entire world population, regardless of where people dwell, the degree to which society is engaged to fight the effects of climate change differ from region to region and between countries. In general, society's participation in formulating public policies is higher in developed countries, where citizens interact directly with government agencies during the policy-making process. As for developing regions, such as Latin America, the formulation of public policies in general is defined as part of the government's agenda, and the understanding of the problem and the effective participation of society are limited.

In general, the climate agenda in Latin America was built as part of each country's foreign policy, and not from a broad debate with society. Thus, the level of engagement - and even the population's level of knowledge about the climate agenda of their countries - is relatively low, the debate happening mainly between the government and some agents who are more directly related to the subject.

In Germany, society's engagement in the *Energiewende* - the national plan for energy transition

- is pretty intense. A wide range of stakeholders were involved in the process of transforming the country's energy supply within an environment of transparency and dialogue. German society participates directly in the plan, mainly through public dialogue forums about the expansion of the country's transmission network⁵¹. Moreover, the continuous exchange of information between government sectors and society creates a high level of transparency, thus contributing to a greater acceptance of the energy transition⁵².

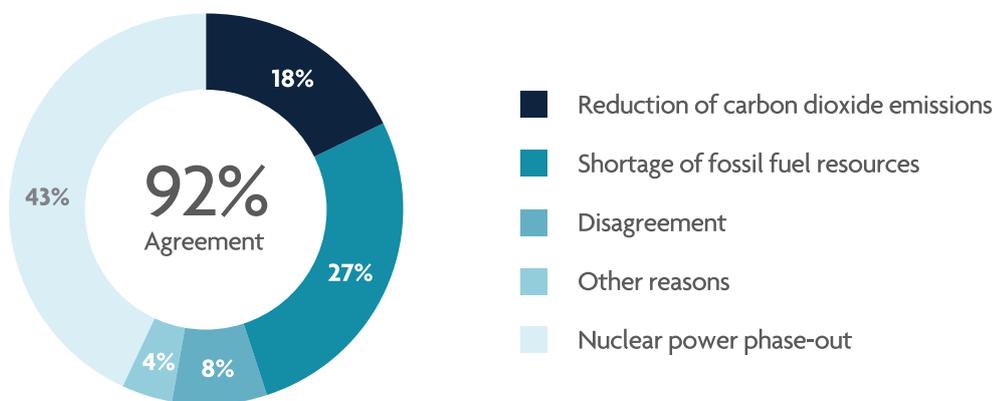
51. *The transmission network expansion is one of Energiewende's most important issues as it will integrate renewable sources (wind and solar) to the existing grid. For more information about the public dialogue forums on the transmission network expansion (Bürgerdialog Stromnetz), see: <http://www.buergerdialog-stromnetz.de/about-buergerdialog-stromnetz-public-dialogue>.*

52. *Federal Ministry for Economic Affairs and Energy (BMWi, in German).*

This process was strongly supported by society. A survey published by the German Renewable Energy Agency shows that 92% of the German population supports the *Energiewende*, for different reasons:

to discontinue its nuclear power plants (43%), due to the shortage of fossil fuels (27%), or to reduce emissions of greenhouse gases (18%)⁵³.

FIGURE 17 – WHY GERMANS SUPPORT THE *ENERGIEWENDE*



Source: PricewaterhouseCoopers, 2015.

Considering the European Union as a whole, several changes underway will contribute to the continent's energy transition. The *Energy Union*, a European Commission project that aims to reduce the continent's dependence on imports of energy sources and diversify its energy supply, will allow for a free flow of energy across its borders and secure supply in all EU countries, for all Europeans⁵⁴. The plan emphasizes the development of renewable energy, energy efficiency, diversification of energy sources, reduction of GHG emissions, among other goals.

European society expects that these changes take place with full participation of the population. In the public consultation carried out during preparation of the new *Renewable Energy Directive* for the post-2020 period, half of respondents mentioned the importance of involving citizens and local communities in the development of renewable energy projects, and also of public awareness and dialogue campaigns⁵⁵. The *Citizens' Energy Forum*, for example, is a communication channel between policy makers of the *Energy Union* and

⁵³. PricewaterhouseCoopers. *Why Germans Support The Energiewende*, 2015.

⁵⁴. European Commission. *Citizens' Energy Forum: consumers at heart of Energy Union. Energy Union and Climate*.

⁵⁵. European Commission. *Citizens' Energy Forum: consumers at heart of Energy Union. Preparation of a new Renewable Energy Directive for the period after 2020*.

society, which meet in an annual event designed to explore the views of consumers and their role in a new energy market⁵⁶.

Another form of involvement of European society in the discussion of its new energy policy is through the *Covenant of Mayors for Climate and Energy*, an initiative in which mayors of several EU cities discuss and contribute to the implementation of measures to achieve the European climate and energy targets⁵⁷. With the discussion of the energy transition occurring at the government level that is closest to the people - the municipality - the European citizen has another channel available to actively participate in the process.

In Latin America, society's participation in the climate change and energy transition discussion has taken place in a more limited way. Recently, however, some countries have made efforts to increase society's participation in discussions on the issue.

In Chile, for example, *Resolución Exenta No. 440* of August 8, 2011, establishes rules for dialogue between all parties involved in the development of projects in the energy sector, including renewable energy. All plans and their implementation schedules should be available to the public, which can give their opinion on the Internet or in dialogue forums over a period of 15 days. This same law establishes the *Consejo de la Sociedad Civil de la Comisión Nacional de Energía*, in order to consult the population on national energy policies. This council is formed by non-profit associations and government, but must also include at least one representative of energy consumers in its composition.

In Mexico, the creation of the *Consejo Consultivo para la Transición Energética* also seeks to include society in decisions regarding the national energy transition policy. The *Consejo* is the permanent forum for consultation and citizen participation that "aims to review and advise the Secretariat on the measures required to meet clean energy targets and energy efficiency measures, as well as the content of the various planning tools and other mechanisms and actions defined in the Energy Transition Law."⁵⁸ In addition to representation on the board, civil society is also heard through public consultations.

In Brazil, channels for popular participation in the energy transition and climate change agendas are available through the Brazilian Forum on Climate Change (FBMC, in its Portuguese acronym) and through communication between the coordinators of the National Adaptation Plan (PNA, in its Portuguese acronym) and society. In addition, PNA developers sought to involve the public in the creation process of this adaptation plan to climate change. Initially, a public call for suggestions was made and then a public consultation was held in order to receive contributions to the PNA. This consultation took place through the Internet and five regional workshops in Manaus, Fortaleza, Brasília, Rio de Janeiro and Curitiba.

Although the PNA developers have considered the consultation process "satisfactory" - and 92% of those that participated in the plan's consultation process consider the adaptation policy relevant for the country - some considerations about the process shall be listed. First, although all regions

56. European Commission. *Citizens' Energy Forum: consumers at heart of Energy Union*, 2015

57. *Covenant of Mayors. The Covenant of Mayors text.*

58. *Secretaría de Energía de México. Sesión de Instalación del Consejo Consultivo para la Transición Energética.*

of the country are represented in the Internet consultation, the low representation of the North and Northeast regions (9%) is a concern, especially when considering that those living in these regions are highly vulnerable to climate change. Second, the participants' education level is not representative of the Brazilian population: 89% of respondents have at least a university degree, while this percentage in the population was about 11% in 2010⁵⁹. In addition, the number of participants in the workshops was not significant (215 people). In the city of Rio de Janeiro, for example, the only city in the Southeast region where a workshop was held, only 15 people attended.

Thus, although governments make an effort to listen to society, the degree of engagement of the Latin American population in the development of energy transition and climate change plans is still low, especially when compared to Europe. Why that happens?

First of all, although Latin American countries have presented recent economic and social development, they still have many problems "of the past century." Argentina, for example, resumed its debt payments just a few months ago⁶⁰. In Mexico, political fragmentation and lack of coordination inside the government contribute for the climate change and energy transition policies to advance slowly⁶¹.

As for Brazil, political and economic instability hinder the progression of agendas related to energy transition. Moreover, even though they consider the issue relevant, the degree of vulnerability of the population contributes for Brazilians not engaging as they should: according to the 2010 Census, 6% of the population has no access to proper water supply and sewage systems (in states like Pará, Acre and Maranhão, this percentage is above 23%)⁶². The unemployment rate in the first quarter of 2016 reached almost 11%⁶³. The 2014 homicide rate was the highest ever recorded in the country: 29.1 homicides per 100,000 inhabitants⁶⁴. With so many more pressing problems, concern about climate change and energy transition does not get the population's attention that it should.

Still about Brazil, as the current energy matrix is already pretty clean, there is a false impression that it is not urgent for the country to invest in renewables, energy efficiency and decarbonisation of the transport sector. In Mexico, high supply of natural gas from the United States also contributes to a lower investment rate in energy transition. Regarding Argentina, the investment gap in conventional energy sources is seen as a barrier to further advancement of renewable sources.

59. Instituto Brasileiro de Geografia e Estatística (IBGE). *Atlas do Desenvolvimento Humano no Brasil*.

60. Zero Hora Notícias. *Argentina Paga Fundos e deixa a Moratória de 15 anos*.

61. Valenzuela, 2014.

62. Instituto Brasileiro de Geografia e Estatística (IBGE). *Atlas do Desenvolvimento Humano no Brasil*.

63. Instituto Brasileiro de Geografia e Estatística (IBGE). *Pesquisa Nacional por Amostra de Domicílios Contínua (PNAD Contínua)*, 2016.

64. IPEA, 2016.

Although the provision of incentives for energy transition in Latin America - both financial and through public policies - has been increasing, it is still limited

Another issue to consider relates to the discovery of new natural fossil resources reserves in these countries – in the Brazilian case, the pre-salt layer, and in the Argentinan example, *Vaca Muerta* - which will allow generating employment and income in these developing countries. To consider not extracting these reserves is a sensitive issue in countries that might use the revenue deriving from the exploitation of these resources to leverage social development.

Finally, although the provision of incentives for energy transition in Latin America - both financial and through public policies - has been increasing, it is still limited. The lack of coordination between different levels of government can also be considered an obstacle. Insufficient investment in innovation also contributes to slowdown the progress in energy transition. Brazil, for example, ranks 84th among 140 countries in the “Innovation” category of the *Global Competitiveness Report*⁶⁵.

Latin American countries’ level of economic and social development makes it difficult for the population to engage on issues regarding climate change and energy transition. The governments’ quest to include society in the debates is also limited and bureaucratic, which lead to decisions on energy and climate policy being disconnected from public opinion. Having so many more immediate problems to solve, decisions about when, where, and how to invest in energy transition end up being made in bureaucrats’ offices, with little public participation.

Paradoxically, the degree of vulnerability of the Latin American population places it at great risk for the effects of climate change. It is, therefore, urgent to address and solve these other problems so that the Latin American society can adapt to and mitigate the effects of climate change.

⁶⁵. *The Global Competitiveness Report*, published annually by the World Economic Forum, assesses the competitiveness of 140 economies. In the report’s latest edition (2015-2016), Brazil ranked 75th (World Economic Forum (WEF). *The Global Competitiveness Report 2015-2016*).



Conclusion

Building an analysis on energy transition in Latin America is a challenging task because the region consists of countries with very different energy structures, with dissonant agendas and complex conjunctural issues. This challenge becomes even greater because energy transition is a multidisciplinary task that requires a cohesive and coordinated planning, since it involves different sectors in the country.

This report aimed at better understanding how each country's peculiarities influence their decisions about energy transition. Throughout the document, we attempted to conduct a comparative parallel between Latin America and Europe, where energy transition and the integration of energy policies are at a more advanced level.

First of all, in Chapter 1, we introduced the discussion on how energy transition, including in Latin America, will be influenced by the Paris Agreement. Then, in Chapter 2, we listed the main differences between Europe and Latin America with regard to energy issues and energy transition, and how these differences induce the decision making of the stakeholders involved. In this Chapter,

in particular, a study of the economic and energy peculiarities of the Latin American countries served as important input for understanding the decisions that affect their energy transition policies.

In Chapter 3, the current efforts made by the selected Latin American countries regarding energy transition were listed through an analysis of the iNDC submitted by each country at COP 21, and the current initiatives undertaken in this area. Then, internal challenges that may hinder these countries' energy transitions were analyzed individually. Finally, Chapter 4 tried to understand why Latin American society engagement in the energy transition policy making is limited, particularly when compared to Europe.

As shown in Chapter 3, Uruguay is a benchmark for energy transition in Latin America. When studying this success case, we identified that what made the rapid development of the renewable use in the country possible was the combination of economic and political stability, clear and objective rules and the promotion of a profitable business model for the industry. The reason other countries find themselves at a lower stage of development on the issue is the lack of at least one of the abovementioned factors.

In addition to the combination of the above elements, the synchrony between them is also important. In most countries, the legal and regulatory frameworks try to incorporate the spontaneous initiatives already underway. For example, regulation for mini and micro distributed generation should be formulated before any economic agent can implement it, something that did not occur in Brazil. The government should lead the discussion in order to guide the process, and not adapt to conditions already established.

A point of concern in all selected Latin American countries is the transport sector. Most countries neglect mitigation of GHG emissions from this sector. In Brazil, for example, the transport sector is more troublesome than the energy sector – which is essentially composed of clean energy. The few initiatives that exist are too timid and focus mostly on liquid fuels. There is no structural change of the system, which should focus on transportation modals that pollute less and are more efficient. Even Costa Rica, ranked as the Latin American leader in clean energy by the WWF report (2014)⁶⁶, has a dirty transport energy matrix.

It is important to clarify that the the decarbonization of the energy matrix should be considered in conjunction with other characteristics of each country. Issues such as deforestation associated with the expansion of the agricultural frontier, besides the need for exploitation of fossil resources as a developmental vector, should not be set aside, despite the need for a global energy transition. In fact, the issue of GHG emissions should be understood in terms of carbon balance. Therefore, Latin American countries, mainly because they are developing countries, should structure their environmental agenda in order to choose the carbon balance as the variable to be mitigated.

Another point to be considered is the possibility of leapfrogging by developing countries, particularly in Latin America. A country's energy transition is a long-term agenda, which depends not only on regulatory efforts and financial incentives, but also on technological developments. European countries, which already have a tradition of investing in research and development (R&D), and are leaders in technology in many economic sectors, are also ahead in the technological research race for the efficient use of renewable energy.

Although Latin American countries are behind in this race, it does not mean they have to go through all the development stages that the developed countries have been through, with regard to renewable technology. Once there is a technological breakthrough, which can standardize technology and make it inexpensive around the world – something that is expected in the case of chemical storage for batteries, for example - there may be equalization between developed and developing countries in the use of renewable energy.

66. World Wide Fund for Nature. *Green Energy Leaders, Latin America's Top Countries in Renewable Energy*. WWF Report. November, 2014.

Related to different social development stages in Latin America and Europe, society's participation in the election of environmental priorities, particularly in the energy sector, is essential to legitimize the government's initiatives as the promoter of the use of renewables

Finally, society's adhesion to climate policy is essential to the success of this agenda. Related to different social development stages in Latin America and Europe, society's participation in the election of environmental priorities, particularly in the energy sector, is essential to legitimize the government's initiatives as the promoter of the use of renewables. Today, what is customary in Latin America is the progress of an environmental

agenda with none or little participation of society. These countries' iNDCs were mostly developed by government bodies and were mostly treated as a matter of international relations, that is, nothing more than a top-down process. The inclusion of society in the discussion is a significant element for the continent's energy transition to be sustainable and successful.

References

BBC MUNDO. *Sin gasoducto al Sur.* Available at: http://news.bbc.co.uk/hi/spanish/business/news-id_7646000/7646941.stm

BENES, Keith; et al. *Low Oil Prices: An Opportunity for Fuel Subsidy Reform.* 2015. Available at: http://energypolicy.columbia.edu/sites/default/files/energy/Fuel%20Subsidy%20Reform_October%202015.pdf.

BMW i – *Federal Ministry for Economic Affairs and Energy.* Available at: <http://www.bmw.de/EN/Topics/Energy/Electricity-Market-of-the-Future/facts-and-figures.html>

Burgerdialog Stromnetz. *About "Burgerdialog Stromnetz" Public Dialogue.* Available at: <http://www.buergerdialog-stromnetz.de/about-buergerdialog-stromnetz-public-dialogue>.

Climate Change Agenda at Subnational Level in Climate Policy Info Hub. *International Climate Policy Architectures: Top-Down and Bottom-Up.* Available at: http://climatepolicyinfohub.eu/international-climate-policy-architectures-%E2%80%93-top-down-and-bottom#footnote3_3t4e8hx.

Covenant of Mayors. *The Covenant of Mayors text.* Available at: http://www.covenantofmayors.eu/IMG/pdf/covenantofmayors_text_en.pdf.

Datafolha. *Mudanças Climáticas: o que pensa o brasileiro?.* Available at: <https://secured-static.greenpeace.org/brasil/Global/brasil/image/2015/Maio/datafolha%20clima.pdf>.

Env. Pol. Gov. 24, 188–203 (2014) **Environmental Policy and Governance** EDF. Available at: <https://www.edf.fr/groupe-edf/information-sur-l-origine-de-l-electricite-fournie-par-edf>

Empresa de Pesquisa Energética (EPE) – *Balanço Energético Nacional 2015.* Available at: <https://ben.epe.gov.br/default.aspx?anoColeta=2015>

European Commission. *Citizens' Energy Forum: consumers at heart of Energy Union.* 2015. Available at: <https://ec.europa.eu/energy/en/news/citizens-energy-forum-consumers-heart-energy-union>.

_____. *Energy Union and Climate.* Available at: http://ec.europa.eu/priorities/energy-union-and-climate_en.

_____. *Preparation of a new Renewable Energy Directive for the period after 2020.* Available at: <https://ec.europa.eu/energy/en/consultations/preparation-new-renewable-energy-directive-period-after-2020>.

Federal Ministry for Economic Affairs and Energy (BMWi, em alemão). *Coordination of the Energy Transition.* Available at: <http://bmwi.de/EN/Topics/Energy/Energy-Transition/coordination.html>.

Greenpeace. *ICMS.* Available at: <http://www.greenpeace.org/brasil/pt/O-que-fazemos/Clima-e-Energia/energia-solar/icms/>.

Institute of the Americas. *Argentina's Energy Transition: The Macri Government's Vision.* Report, 2016. Available at: https://www.iamericas.org/documents/energy/reports/Argentinas_Energy_Transition_2016.pdf.

Instituto Brasileiro de Geografia e Estatística (IBGE). *Atlas do Desenvolvimento Humano no Brasil.* Available at: <http://www.atlasbrasil.org.br/2013/pt/consulta/>.

_____. *Pesquisa Nacional por Amostra de Domicílios Contínua (PNAD Contínua).* 2016. Available at: ftp://ftp.ibge.gov.br/Trabalho_e_Rendimento/Pesquisa_Nacional_por_Amostra_de_Domicilios_continua/Trimestral/Tabelas/pnadc_201601_tabelas_brasil.zip.

Instituto Costarricense de Electricidad (ICE). Available at: http://gobierno.cr/wp-content/uploads/2015/06/matriz_folleto_ICE.pdf

Instituto de Pesquisa Econômica Aplicada (IPEA). *Atlas da Violência 2016.* Available at: http://infogbucket.s3.amazonaws.com/arquivos/2016/03/22/atlas_da_violencia_2016.pdf.

Inter-American Development Bank (IADB). *Energy Database. 2013.* Available at: <http://www.iadb.org/en/topics/energy/energy-database/energy-database,19144.html?view=v11>.

_____. *Projects: Mexico.* Available at: <http://www.iadb.org/en/projects/project-details,1301.html?query=&adv=true&Country=ME&Sector=EN&tab=1&page-PIP=1&pageAPP=1&order=asc&sort=country&page=2>.

Intergovernmental Panel on Climate Change (IPCC). *Climate Change 2014: Synthesis Report.* 2014. Available at: http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf.

_____. *Climate Change 2007: Synthesis Report.* 2007. Available at: https://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_full_report.pdf.

International Energy Agency (IEA). *Decoupling of global emissions and economic growth confirmed.* 2016. Available at: <https://www.iea.org/newsroomandevents/pressreleases/2016/march/decoupling-of-global-emissions-and-economic-growth-confirmed.html>.

_____. *World Energy Outlook.* 2015. Available at: <http://www.worldenergyoutlook.org/weo2015/>.

International Monetary Fund (FMI). *World Economic Outlook: Too Slow for Too Long.* 2016. Available at: <http://www.imf.org/external/pubs/ft/weo/2016/01/pdf/text.pdf>.

LINS, Clarissa; et al. *Geopolítica de Óleo e Gás na América Latina.* 2015. Available at: http://www.kas.de/wf/doc/kas_43642-1522-5-30.pdf?160217181854.

Massachusetts Institute of Technology (MIT). *Atlas.* 2014. Available at: http://atlas.media.mit.edu/pt/visualize/tree_map/hs92/export/ven/all/show/2014/

Ministère de l'Environnement, de l'Énergie et de la Mer – *Bilan énergétique de la France pour 2014.* Available at: <http://www.developpement-durable.gouv.fr/Le-bilan-energetique-de-la-France,5823.html>

Ministerio de ambiente y energía – Dirección sectorial de energía - *Balance Energético Nacional de Costa Rica 2011.* Available at: <http://www.dse.go.cr/es/03Publicaciones/02Estadisticas/balances/DocumentoBalance2011.pdf>

Ministerio de Energía y Minería (MINEM). *Energías Renovables em Argentina: Nuevo Marco Regulatorio y Perspectivas 2016+.* 2016. Available at: http://www.energia.gob.ar/contenidos/archivos/Reorganizacion/renovables/presentaciones/ARGENTINA_-_Energias_Renovables_-_Nuevo_Marco_Regulatorio_y_Perspectivas_2016.pdf.

_____. *Potencia Instalada 1976-2012.* Available at: <http://www.energia.gob.ar/contenidos/verpagina.php?idpagina=3140>.

_____. *Balance Energético 2014.* Available at: <http://www.energia.gov.ar/contenidos/verpagina.php?idpagina=3366>.

Ministerio de Industria, Energía y Minería (MIEM). *Balance Energético Nacional Uruguay Preliminar 2015.* Available at: <http://www.dne.gub.uy/-/balance-energetico-preliminar-2015>.

_____. *Balance Energético Nacional Preliminar 2015.* Available at: <http://www.miem.gub.uy/documents/15386/7730255/BALANCE%20PRELIMINAR%202015.pdf>

Ministério de Minas e Energia (MME) – *Resenha Energética Brasileira (Exercício de 2014)*. Available at: <http://www.mme.gov.br/documents/1138787/1732840/Resenha+Ener%C3%A9tica+-+Brasil+2015.pdf/4e6b9a34-6b2e-48fa-9ef8-dc7008470bf2>

Ministério do Desenvolvimento, Indústria e Comércio Exterior (MDIC). *Invest in Pernambuco*. Available at: <http://investimentos.mdic.gov.br/public/arquivo/arq1348852119.pdf>.

NANCE, Peter K. *Investing in Mexico's Energy Infrastructure Series: Renewable Energy and Cross-Border Prospects*. ICF International, White Paper. 2014. Available at: http://www.ourenergypolicy.org/wp-content/uploads/2014/10/Mexico_Energy_Renewable_Cross_Border_Prospects-1.pdf.

PricewaterhouseCoopers. *Why Germans Support The Energiewende*. 2015. Available at: <http://strom-report.de/medien/german-energiewende.png>.

Secretaría de Energía de México. *Sesión de Instalación del Consejo Consultivo para la Transición Energética*. Available at: <https://www.gob.mx/sener/documentos/sesion-de-instalacion-del-consejo-consultivo-para-la-transicion-energetica?idiom=es>.

Secretaría de Energía (SENER). *Balance Energético Nacional 2014*. Available at: http://www.gob.mx/cms/uploads/attachment/file/89382/Balance_Nacional_de_Energ_a_2014.pdf

_____. *Sistema de Información Energética (SIE)*. Available at: <http://sie.energia.gob.mx/bdiController.do?action=cuadro&subAction=applyOptions>

The Guardian. *Uruguay makes dramatic shift to nearly 95% electricity from clean energy*. 2015. Available at: <https://www.theguardian.com/environment/2015/dec/03/uruguay-makes-dramatic-shift-to-nearly-95-clean-energy>.

The Wall Street Journal. *Low Oil, Gas Investment to Have Long-Term Impact on Supply, IEA Chief Says*. 2015. Available at: <http://www.wsj.com/articles/low-oil-gas-investment-to-have-long-term-impact-on-supply-iea-chief-says-1448290926>.

The World Bank. *Global Economic Prospects: Divergences and Risks*. 2016. Available at: <http://www.worldbank.org/en/publication/global-economic-prospects>.

_____. *World Bank Data – World Development Indicators*. Available at: <http://wdi.worldbank.org/table/3.7>

_____ . *World DataBank*. Available at: <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators#>.

United Nations Environment Programme (UNEP), Bloomberg New Energy Finance (BNEF). *Global Trends in Renewable Energy Investment*. 2016. Available at: http://fs-unep-centre.org/sites/default/files/publications/globaltrendsrenewableenergyinvestment-2016lowres_0.pdf.

United Nations Framework Convention on Climate Change (UNFCCC). *Doha Amendment to the Kyoto Protocol*. 2012. Available at: http://unfccc.int/files/kyoto_protocol/application/pdf/kp_doha_amendment_english.pdf.

Uruguay XXI. *Energías renovables: Oportunidades de Inversión*. 2014. Available at: <http://www.uruguayxxi.gub.uy/inversiones/wp-content/uploads/sites/3/2014/07/Informe-de-energias-renovables.pdf>.

VALENZUELA, Jose Maria. *Climate Change Agenda at Subnational Level in Mexico: Policy Coordination or Policy Competition?*. Environmental Policy and Governance, páginas 188 a 203. 2014.

World Economic Forum (WEF). *The Global Competitiveness Report 2015-2016*. Available at: <http://reports.weforum.org/global-competitiveness-report-2015-2016/>.

_____ . *Future Oil Demand Scenarios*. 2016. Available at: http://www3.weforum.org/docs/Future_Oil_Demand_Scenarios.pdf.

World Energy Council (WEC). *Data*. 2011. Available at: <https://www.worldenergy.org/data/resources/region/latin-america-the-caribbean/>.

_____ . *World Energy Issues Monitor*. 2016. Available at: <https://www.worldenergy.org/wp-content/uploads/2016/03/2016-World-Energy-Issues-Monitor-Full-report.pdf>.

World Resources Institute (WRI). *CAIT Climate Data Explorer: Historical Emissions*. 2012. Available at: [http://cait.wri.org/historical/Country%20GHG%20Emissions?indicator\[\]=Energy&indicator\[\]=Industrial%20Processes&indicator\[\]=Agriculture&indicator\[\]=Waste&indicator\[\]=Land-Use%20Change%20and%20Forestry&indicator\[\]=Bunker%20Fuels&-year\[\]=2012&focus=&chartType=geo](http://cait.wri.org/historical/Country%20GHG%20Emissions?indicator[]=Energy&indicator[]=Industrial%20Processes&indicator[]=Agriculture&indicator[]=Waste&indicator[]=Land-Use%20Change%20and%20Forestry&indicator[]=Bunker%20Fuels&-year[]=2012&focus=&chartType=geo).

----- CAIT Climate Data
Explorer: Paris Contribution Map. Available at:
<http://cait.wri.org/indc/>.

World Wide Fund for Nature (WWF). *Green Energy Leaders, Latin America's Top Countries in Renewable Energy*. WWF Report. 2014. Available at: <http://www.wwf.de/fileadmin/fm-wwf/Publicationen-PDF/WWF-Report-Green-Energy-Leaders.pdf>.

Zero Hora Notícias. *Argentina Paga Fundos e deixa a Moratória de 15 anos*. 2016. Available at: <http://zh.clicrbs.com.br/rs/noticias/noticia/2016/04/argentina-paga-fundos-e-deixa-a-moratoria-de-15-anos-5785058.html>.



MANTENEDORES DA FGV ENERGIA

Premium (Elite)



Master





KONRAD-ADENAUER-STIFTUNG E.V. | *Contact:* Dr. Christian Hübner | +51 1 320 2870
REGIONAL PROGRAMME ENERGY SECURITY AND CLIMATE CHANGE IN LATIN AMERICA
Calle Cantuarias 160 Of. 202, Miraflores – Lima 18, Peru | Energie-Klima-La@kas.de
www.kas.de/energie-klima-lateinamerika