

## **"Climate change mitigation strategy for the residential sector, Buenos Aires City - Argentina"**

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### **Abstract**

The current report aims to propose an innovative intervention to contribute to climate change mitigation in urban areas through improving energy efficiency in the residential zones of the South of Buenos Aires City.

In the pursuit of this objective, and in order to take cognizance of the practices suggested, a research and an analysis of specific problems and different mitigation proposals were taken into account, as well as a research of a set of tools from both the international and national contexts.

On the following stages, documents of different nature and origin were surveyed in order to emphasize the current diagnosis and actions that take place in Buenos Aires.

After completing the research tasks, I proceeded to analyze the information collected. Some of the main conclusions are:

- Actions that are currently performed in Buenos Aires are insufficient according to the verified results of the latest inventory of greenhouse gases (GHGs).
- There are no governmental measures aimed to improve efficiency in the residential sector which signify 33% of total emissions.

Given these circumstances, in this thesis, it is pretended to propose an innovative mitigation tool for the residential sector, with the aim to contribute to the city's mitigation targets toward 2030 to which it committed itself.

Moreover, the proposal seeks to grant an innovative management tool, jointly with foreign credit institutions, in the context of climate finance mechanisms. At the same time, it is proposed a system of tax on improvements that seeks to replicate the intervention in different areas of the city, in line with the international funds objectives and requirements.

### **Introduction**

The guidelines have been defined as follows:

"Mitigation strategy for the residential sector; Buenos Aires City - Argentina."

The needs that have motivated the preparation of this work were directed to the recognition and establishment of a proposal that would:

- Identify and develop urban and policy interventions needed to improve the performance of Buenos Aires city in mitigating climate change.

It was identified a situation in which the GHGs emissions of Buenos Aires City fail to stabilize or decrease. In this regard, mitigation actions to improve the performance are considered a priority. In this framework, the specific objectives are:

- Identify mitigation actions undertaken, its strengths and weaknesses.
- Identify the critical actors whose actions are essential to stabilize and gradually reduce GHGs emissions.

From the statement, the proposal is then focused on defining alternative approaches to achieve improved energy efficiency in buildings, in order to reduce indirect GHGs emissions from the "energy" sector; given the low rates of construction that were detected in the south of Buenos Aires City. This proposal is focused on existing buildings.

### **Justification**

Bearing in mind the fact that the world is going through a rapid urbanization process, new and classic cities are growing at unprecedented rates. In 1950, only 29% of the world population lived in cities. Since 2010, the percentage rose up to 52%. A typical case is the city of Shenzhen (China), with a rural population of 30,000 in 1980, and currently over 10 million inhabitants, number reached just in 35 years. Worldwide, the projection is 58% for 2030 and 67% for 2050. Countries with these kinds of changes are developing countries. (The Sustainable Development Solutions Network-UN, 2012).

Given the rapid growth of cities, it is estimated that the occupation of land will increase between 56% and 300% by the period 2000-2030, and US\$6 billion will be invested in the development of urban infrastructure by 2030. This fact becomes a challenging opportunity to design, promote and guarantee low carbon and resilient infrastructure. (Technical Expert Meeting on Urban Environment, 2014).

Studies estimate that between 71% and 76% of GHGs emissions from energy use are attributable to urban areas. In turn, the expansion of urban infrastructure with a logic of Business As Usual (BAU) (with the same logic of growth and technology) will generate 470 giga tons of carbon emissions (IPCC, 2014). In addition, 30% of the total emissions are attributable to buildings and 15% to cars (Harvard, 2012). It is necessary to note that 30% of the energy consumed in commercial buildings is not used.

Focusing on these data, is relevant to channel mitigation efforts through interventions at the city level, acting synergistically with national efforts, addressing this subject with interventions at multiple scales.

From the available data from the last Greenhouse Gas Inventory made in 2012, it can be verified that the amount of CO2 tons generated in the analyzed period did not decreased or held constant with different mitigation projects. On the contrary, it grew up to 8.8%.

For example, in Buenos Aires City, if this trend does not show a gradual reduction, it is possible that the estimated 33% reduction by 2030 compared to 2008 (target agreed by the Local Government) will not be achieved.

Costs of (BAU) policies with the current emission path are very high, and there are externalities that are not incorporated in the socio-economic indicators. A relevant example is the cost of time wasted in traffic jams (together with other transportation-related costs) reaching a 3.4% of the city's GDP, one of the highest in the region.

Considering the above mentioned facts, it is evident the need for modifying urban interventions in the urban space in order to start to reduce the GHG emissions, necessary to achieve the goals agreed by the Local Government.

## Chapter I

### Theoretical framework

Climate change is a global phenomenon and has an impact on different sectors. The world is emitting about 55 billion tons of CO<sub>2</sub>e. Of that total, 35 billion correspond to CO<sub>2</sub>, of which 46% (16 billion) remain in the atmosphere and the remaining 54% is absorbed by forests, soils and oceans (SACHS, 2014). It is understood as a change of climate that is attributed directly or indirectly to human activity, which alters the composition of the global atmosphere and that works synergistically with the natural climate variability observed over comparable time periods (UNFCCC, 1992).

Global warming has occurred in the distant past as a result of natural influences, but the term is most often used in reference to predictions of warming expected as a result of increased emissions of greenhouse gases. Scientists largely agree with the fact that the surface of the earth has warmed by 1 degree Fahrenheit over the past 140 years. (The Intergovernmental Panel on Climate Change-2011)

Our actions have an impact for 40 or 50 years, for this reason, even if we avoid greenhouse gas emissions completely, the permanence of the current gases in the atmosphere would generate an increase between 0.6 and 1°C. The current international target (Led by the IPCC and the UN) aims to keep a limit of 2°C increase in temperature, where adaptation measures could be efficient to support changes (Stern, 2007).

Nicholas Stern describes that, by analyzing the economic variable and its relation to climate change, the benefits of the adoption of strong and early action on climate change exceed the costs.

*"The less mitigation we do now, the greater the difficulty of continuing to adapt in future."* (Stern, 2007).

There are certain scenarios that change depending on whether we continue emitting with the current rates, known as (BAU), independent of the emergence of new technologies, and there are multiple scenarios that depend on meeting reduction targets and incorporating new mitigation measures. The IPCC Fifth Assessment Report (AR5) conducted 900 mitigation scenarios and was integrated into large-scale models showing mitigation paths with a mid-century horizon and afterwards. In the report, four paths depending on the amount of emissions (RCP2.6, RCP4.5, RCP6, and RCP8.5) are described. By analyzing the graph of projections, the RCP2.6 is most beneficial given the tendency to stabilize by 2020 and then to decline in the following years. It follows the RCP4.5, which evidence a gradual growth until 2040 and then begins to decline. This scenario is one of the most logical, considering that international negotiations are not having results that translate into effective results in lower emissions annually and parallel economy expands emissions. The remaining scenarios are most negative in the RCP6, where there is a very strong growth until 2080, which would begin to decline sharply, and the RCP8.5 (worst case scenario); gradually increase emissions during this century.

In the current paradigm of the "global city", as command centers of the world economy are part of a network of urban nodes of different levels, hierarchies and importance. These

global metropolitan areas are also important emitters of GHGs and are responsible for more than 70% of global energy-related carbon dioxide emissions.

Climate change poses a big risk for cities, affects the formation of the "urban heat island effect" increasing the average temperature of the urban area, accentuated by extensive soil sealing. Other risk is related to the low vegetation cover that affects the behavior of rainfall and given the increasing possibility of extreme events, local infrastructure can be overloaded.

In April of 2014, the record of 400 ppm CO<sub>2</sub> equivalent was reached in the atmosphere compared to pre industrial revolution levels. Thus, currently, the world is 0.8 ° C warmer.

Examples:

Portland, Oregon (USA) "Climate Action Plan-2009"

Portland is considered one of the most sustainable cities in the United States, as a precursor of different interventions with environmental criteria at the end of the decade of 1980. Referring to climate change, an Action Plan was developed in 2009 to reduce an 80% the GHG emissions by 2050 compared to 1990 levels and targeted a shorter-term objective of 40% reduction by 2030. It specifically targets and develops targets for buildings and energy sectors, urban morphology and mobility, consumption and solid waste, urban forestry, food and agriculture, social inclusion, local governance and climate change in general. Portland has a per capita emission of 12 tons lower than the national average of U.S.A., between 19 and 20 tons. However, the City aims to reach 5 tons per capita for 2030.

Copenhagen (Denmark) "Climate Plan 2025"

The action plan held in the City of Copenhagen establishes the year 2025 as the time horizon to achieve neutrality. To achieve this goal, certain activities are proposed to increase ambition; the principal is an increase in energy efficiency in buildings. The percentage of emissions generated by this sector is huge compared to others whose reduction targets have already been largely achieved, such as transport. As a highly developed city, initiatives have a high potential of being supplied by renewable energy by the year 2025, specifically offshore wind power (taking into account the small size of the country).

## **Chapter II**

### **From Latin America to Buenos Aires City**

In Latin America in general, and in Argentina specifically, there is a particularity; approximately 90% of the population lives in urban areas. Being the developing region most urbanized in the world, climate change generates an increasing pressure on them in a wide range of issues either in the existing infrastructure, resilience capacity, to issues related to the multi-jurisdictionality and consequences on governance that entails.

These cities often have similar urban growth patrons: are suburbanized metropolitan areas, mostly with low densities, occupying rural areas with highly valuable in terms of production, landscape, environmental and sometimes floodable territories, which added to soil sealing, it become susceptible to flooding, being affected by increased frequency and intensity of rainfall because of the effects of climate change. On the other hand, providing

infrastructure to this geographically isolated population it has an enormous cost to the state, transforming cities into polarized, dual and disintegrated territories, with inefficient connectivity with the rest of the agglomeration. The inhabitants of high socioeconomic level mobilize using their private car and the low-income populations have no right to the city, because the inexistent public transport work as an urban barrier.

Broadly speaking, Latin American countries have a similar vulnerability to climate change effects without being among the most GHG emitting countries. Anyway, this particularity is not a valid concept to avoid mitigation or adaptation to climate change, and to take responsibility of the future GHG emissions generated within the city.

### **Objective**

Analyze the role of Buenos Aires City in the implementation of its public policies and urban interventions to reduce GHG emissions and achieve the reduction targets established (Period 2000-2012). This work is framed in an urban and regional program to build technical basis for mitigation and adaptation to climate change in Buenos Aires.

- Identify strengths, weaknesses and omissions, as well as institutional capacities and opportunities available locally in the field related to urbanization and climate change.
- Propose an innovative urban approach to reduce GHG emissions and contribute to achieve the reduction targets.

### **Chapter III**

#### **Buenos Aires City and Climate Change**

The Metropolitan Area of Buenos Aires has 12,806,866 inhabitants (Census 2010), approximately 31.92% of the population of Argentina in only 1% of the total national territory. The relation between the Metropolitan Area and Buenos Aires City is inseparable because both are part of the same functional territory with a continuous interdependence, including social, economic and productive relation. The jurisdictional barrier not only is a limitation for the environmental projects, but also for any plans outlined in the region. In terms of urban planning, is one of the greatest weakness of the agglomerate.

On a daily basis, Buenos Aires City receives 3.2 million people and 1.1 million vehicles from the hinterland, in addition to the almost 3 million inhabitants of the City and the 1,300,000 registered cars. Current emissions from transport are 5.7 million tonnes of CO<sub>2</sub> per year, and if interventions are made, projections for 2030 are 7.1 million tons of CO<sub>2</sub>, with 90% coming from private transport. (Buenos Aires, Ministry of Urban Development, Undersecretary of Transportation, October 2010).

According to the Government of Buenos Aires City, the expected effects of climate change are: increased rainfall across the region, rising sea level, increasing intensity and wind direction changes eastward, increased frequency, duration and intensity of extreme weather events (storms, storm surges, heat waves), vector expansion, increased pressure from health systems, degradation of air quality by increased production of O<sub>3</sub>. (Lockhart, 2014)

It is relevant to highlight the status of Buenos Aires City as autonomous city since 1996 when the new legal status granted by the republican regime, with the executive, legislative and judicial branches, contemplating a communal organization.

This situation implies a new approach in all the problems and local issues because Buenos Aires began to develop a new political life. Since these changes, the city has been more independent from the national government, has allowed executing works of greater scope and impact, and has strengthened its position and weight with the rest of the provinces.

Regarding environmental issues, Buenos Aires City has a voice like any other province in the Federal Environmental Council (COFEMA). This Council represents a major mechanism for strengthening federalism while the provinces have the opportunity to interfere with the process of national development. It is very important considering that the provinces own their resources and have the power to exploit them for economic and social development.

### Local regulations

Buenos Aires City has developed the following acts directly or indirectly related to climate change.

CABA legislation related to climate change

Acts	
3871	Adaptation and Mitigation to Climate Change
3246	Energy Saving and Efficiency
4024	Promotion of solar thermal and photovoltaic panels
4428	Green Roofs
4237	Rainwater Collection Systems
4458	Thermal Insulation
123	Environmental Impact
1356	Air Quality
1854	Integral Solid Waste Management (Zero Garbage)

The most important act regarding climate change management is The Adaptation and Mitigation to Climate Change Act (N°3871), which in Article 1 states:

*"This act aims to establish the actions, instruments and appropriate strategies for adaptation and mitigation to climate change in Buenos Aires, to reduce human and natural systems vulnerability, protect them from their adverse effects and reap its benefits."*

### "Buenos Aires Action Plan - 2030".

In 2009, Buenos Aires City created the Interministerial Climate Change Team with the mission of developing an Action Plan that would allow taking action and preparing the city for the effects of climate change. This team, led by the Environmental Protection Agency, conceived an Action Plan as planning oriented comprehensive policies to mitigate and adapt to the adverse effects of climate change for the period 2010-2030. (GCBA, 2015).

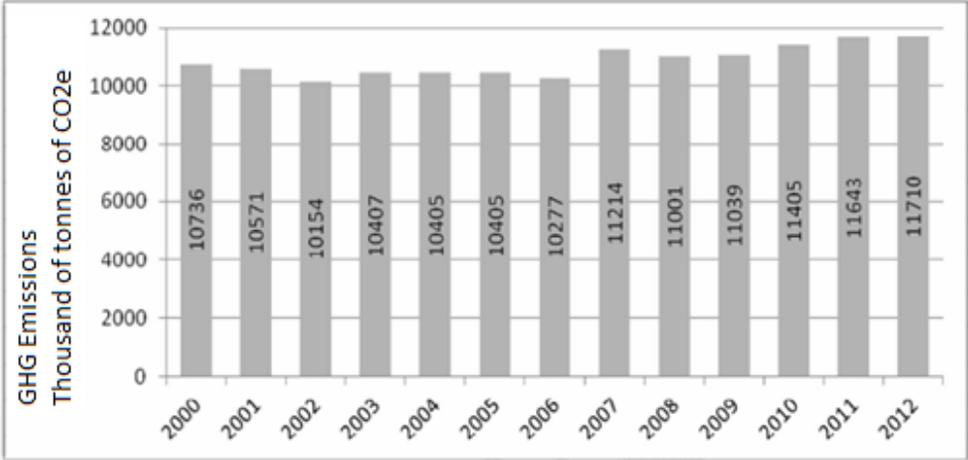
The Buenos Aires Action Plan focuses specifically on the issue of Climate Change and applies the GHG inventory methodology, developed by ICLEI and used by all member countries of C40 Cities.

The report provides a survey of the total emissions for the 2000-2012 periods, specifying which is the share of each sector (Energy, Transport, Waste and Government), and also performs more specific differentiations as community and government emissions.

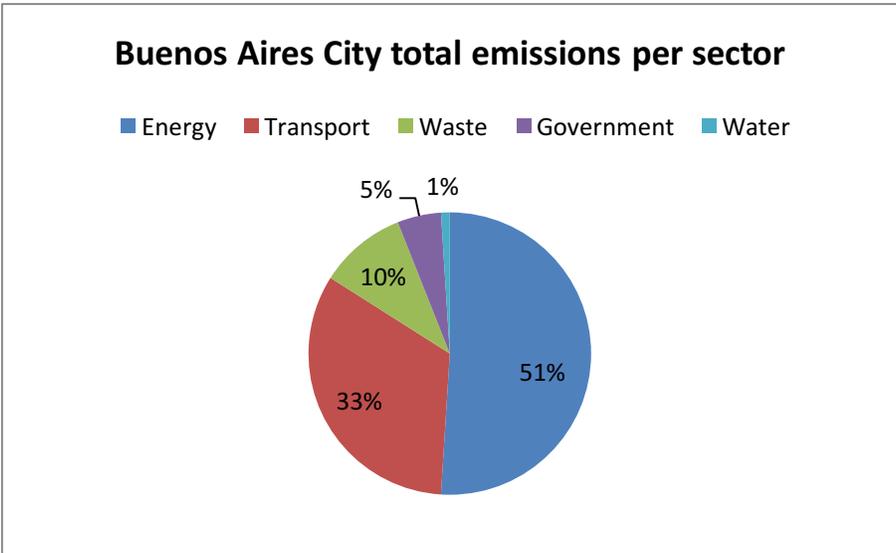
Based on this survey and the report presented, the most relevant sectors and their contribution to GHG emissions are:

- Energy: 51% of the total emissions of the city. It is contemplated, within this group, the residential and commercial buildings that contribute 33 and 16% respectively. As well, the industrial sector contributes a 5%. In this sector, the specific emissions of governmental activities includes public buildings and public lighting, accounts for 5% of the total emissions of the city.
- Transport: 33% of the total emissions of the city.
- Waste: 10% of the total emissions of the city.

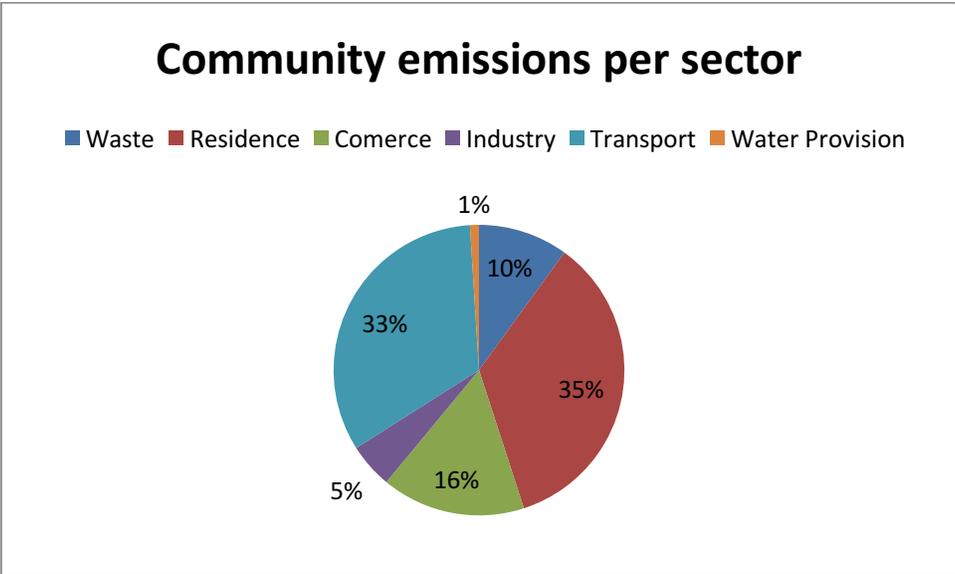
Buenos Aires GHG Inventory



Inventory of GHG period 2000 to 2012; Buenos Aires, Argentina, 2014



Inventory of GHG period 2000 to 2012; Buenos Aires, Argentina, 2014

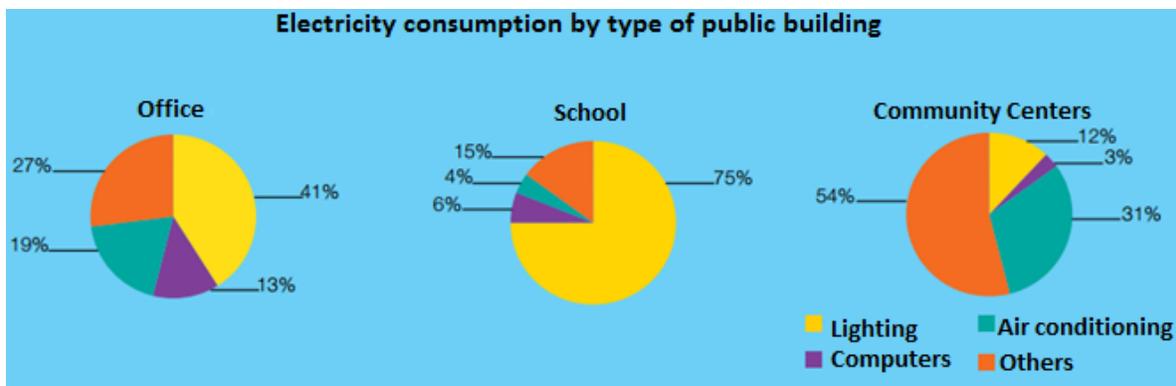


Inventory of GHG period 2000 to 2012; Buenos Aires, Argentina, 2014

**Climate Change Interventions in Buenos Aires**

**1. Energy Sector - Contribution to GHG emissions: 51%.**

- Energy Efficiency Program in Public Buildings (PEEP)



Inventory of GHG period 2000 to 2012; Buenos Aires, Argentina, 2014

- LED lighting incorporation

## 2. Transport Sector - Contribution to GHG emissions: 33%.

- Exclusive lines for buses and bicycles
- Short-term projections: Electric buses
- Congestion Charge zone
- Pedestrianization

## 3. Waste Sector - Contribution to GHG emissions: 10%

Integral Urban Solid Waste Management

- Recuperation, recycling and return of the recoverable waste to the productive cycle

## 4. Green spaces and carbon sinks

- Green roofs
- Improvement and extension of current green spaces

## Proposal

### Guidelines and criteria

With the analysis presented about Buenos Aires City, it can be identified the following axes:

Although the city is undertaking measures to reduce GHG emissions, it fails in its reduction and stabilization. As a result, mitigation measures are considered a priority.

Given that energy consumption accounts for 51% of the city emissions, the present report was able to verify that this is one of the sectors whose interventions are not enough to reduce GHG emissions.

More specifically, the deficit is detected in energy inefficiency in residential and commercial buildings, as the government intervention focuses only in the limited public buildings.

In this sense, the implementation of complementary urban environmental interventions to those carried out by the government will reduce total GHG emissions generated and would achieve the reduction goals agreed.

### **Climate Finance for the residential sector**

The issue of climate finance was addressed at the Conference of the Parties (COP) 13 held in Bali in 2007. This mechanism allows initiatives that aim to manage the theme of change climate and GHG emissions reductions, achieving the goal of not exceeding the 2°C.

This proposal is a potential project to be financed by the international bodies and frameworks responsible for mitigation climate funds; can be loans or grants:

- The Global Environmental Fund (GEF).
- The Green Climate Fund (GCF).
- NAMA Facility.

The territory was selected by an analysis of local dynamics, like socio-economic stratification of the target population and other variables. Energy audits will be conducted and according to the results, necessary improvements will be made. Beneficiaries would not enjoy the benefits of reduced costs until contributions for improvements received are settled. The continuous contributions after the initial investment for the project will be replicated in the rest of the territory. Once the beneficiaries pay the benefits from the project, they will begin to acquire the operating costs reductions.

This initiative has as its main strength, the fact of having specific international financing for activities related to climate change, and there is a great willingness internationally by the funds and the United Nations.

However, the present intervention pilot project intends to be replicated from the effects on the first experience. The goal is to cover the widest possible territory with these improvements in facilities, from the resources initially invested, plus contributions for improvements.

As highlighted by the Architect and Urban Designer, Peter Calthorpe, we must focus on energy plaintiffs, beyond suppliers.

*"Tackling climate change is a bit like the war on drugs, you can go by the supplier (power plants), or may pursue addicts, (inefficient buildings and suburban sprawl). Both are necessary."*

*"Urbanism is, in fact, our single most potent weapon against climate change, rising energy costs, and environmental degradation"*

(Peter Calthorpe, 2011).

### **Final Product and Operations Unit**

The final product of the intervention is to incorporate energy efficiency mechanisms in a territory located in the southern part of Buenos Aires City, whose buildings do not have a

significant rate of renewability, basing and ensuring prolonged positive effects on the territory.



Own development with google maps 2015



Own development with google maps 2015

The operating unit for the management of the project is the Environmental Protection Agency of the Government of Buenos Aires and is in charge of ensuring the replicability of the project in the rest of the City.

### Justification

It is considered that the selected project is the most appropriate to respond to the problem detected for the following reasons:

- Account with funds from donations from international bodies.
- Tear down the barriers of financing.
- Contemplate an economic feedback through the instrument of contribution for improvements.
- Poses a system to replicate the intervention on multiple areas of the city.
- Has a long term time horizon, looking for the greatest transformation over the territory as possible.
- Mitigates climate change.
- Relieves power grid.
- Develops the southern area of the city, which it has the lowest building renewal rates.
- Relies on an Instrument called "Contribution for Improvements" that it is applied after the intervention. It recovers the capital gain in the building generated by the public plan and ensures the replicability.

#### Logical Framework Approach

	Narrative Summary
General Purpose	Reduce GHG emissions from the residential sector
Specific Objective	Make improvements to buildings within the selected area to improve energy efficiency.
Products	1. Increased energy efficiency of the housing complex. 2. Decreased operating costs for users.
Activities	1.1 Conduct a public hearing with the beneficiary community. 1.2 Making Energy Audit. 1.3 Run the intervention in the territory. 1.4 Measure and monitor energy savings.

#### Conclusion

This final work was based on the global trend where cities, gradually, were transformed in transcendental actors in mitigation and adaptation to climate change, considering the great population growth, the increased concentration of individuals, the projected number of extreme events in urban areas increase (usually affecting the poorest), among other issues.

The international climate change negotiations were not successful for world major emitters in achieving good results in national GHG reductions. Based on this difficult and complex scenario of global negotiations in the framework of the United Nations, where countries fail to commit ethically to make contributions improvements according to their level of historical and current impact, large global cities and metropolitan areas, are transformed into a necessary actor to act synergistically with other levels of government, with the aim of increasing the possibilities of improving national contributions and while fostering a thriving and economically attractive territory for foreign direct investment. The Paris Agreement can be a turning point for a properly articulation between the national and subnational level and to achieve a low carbon future, but It is subject to the rapid implementation and the international commitment.

It was decided to address this issue by focusing, firstly, in the Latin American region and its special characteristics, where large concentrations of urban population have similar features and territorial dynamics.

Specifically referring to Buenos Aires City, the inventory analysis of greenhouse gases studies the evolution of GHG emissions in the period 2000-2012. The graph previously shown have a tendency to emissions stability, but you can perceive a slight increase from the period 2007 onwards.

Given these results, the final work was aimed to analyze the actions and omissions of the local government of Buenos Aires City on climate change, to identify weaknesses that could influence negative GHG inventory records.

Thus, it was identified that the residential sector, one of the largest emitters in the energy sector, did not have an energy efficiency plan, signifying one of the greatest weaknesses in terms of mitigation strategies for the city.

This proposal is a pilot intervention that can improve the energy efficiency of the areas proposed whose rates of renewability of buildings is low, thus ensuring that improvements in buildings have results for extended time. On the other hand, a replicability of the proposal is sought in the rest of the southern area of the city, through initial funding and the continued contribution from the beneficiaries of the retrofitted buildings under the instrument of contribution for improvements. The savings by improvements in energy efficiency are not initially kept by the beneficiaries, in order to pay the total enhancements, is thus a continuous monetary flow to invest in improvements in other parts of the city, guaranteeing the replicability of the project.

Since the environmental factor is not internalized in the national accounts, financial tools arising from international negotiations are a great opportunity towards sustainable development in developing countries such as Argentina.

A synergistic action between the actors involved is required. As well as the government action is a priority, the community ownership with the project is also necessary. They must assume their responsibility and take climate change as one of the key issues in the development of the territory.

Cities that take responsibility and take decisions on climate change, either on adaptation or mitigation, depending on the nature and needs of the city, is of high importance, considering that cities are gradually being transformed into the areas with the largest population on the world. It must be addressed as a key variable to the development of future generations and as an ethical issue.

Cities cannot continue abstracted from the territory to which they belong, have to be parts of it, must adapt and plan for the future considering the new environmental, economic and social challenges ahead. Even more, if in the short term no major changes in the market are taken with the BAU scenario.

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