NTNU
Norwegian University of
Science and Technology

Development of Sustainable Cities

Policy development and implementation
challenges of climate mitigating efforts in
Belo Horizonte, Brazil

Marcela Costa Pinto
Reggiani

Globalization
Submission date: June 2016
Supervisor: John Eilif Hermansen, IØT

Norwegian University of Science and Technology
Department of Industrial Economics and Technology Management

Problem Description

The purpose of the study is to understand the challenges linked to the policy development and implementation for climate mitigating in Belo Horizonte, Brazil. The challenges directly impact Belo Horizonte's goal of being a more sustainable city. Using policy implementation theory and stakeholder analysis, the goal is to point out the challenges related to the PREGEE formulation and implementation, the plan for reducing the GHG emissions in Belo Horizonte, the third biggest city in Brazil. Thus, the purpose is to analyze the PREGEE under the three main criteria of policy implementation theory: 1) Local government capacity; 2) local framing; and 3) political factors and actors. Supporting this theory, the stakeholder analysis will provide ways to evaluate the stakeholders' interests and power in relation to the PREGEE formulation and implementation, as well to provide relevant information for the analysis.

Main content:

- Introduction to the topic and macro background of Climate change negotiations and the national (Brazil) position in it.
- Presenting the methods and tools to support the analysis.
- Outlining the main concepts and theory through literature review on policy implementation, stakeholder analysis and sustainable cities.
- Shaping a framework for Belo Horizonte and its related actions towards sustainability - more specifically, climate change mitigation and adaptation.
- Shaping the governance mechanisms for climate change in Belo Horizonte
- Discussing the PREGEE formulation and implementation under the light of the chosen theoretical framework and trying to outline its main challenges.
- If possible, outline a set of recommendations for better development and implementation of mitigation policies, supported by the analysis of ISO 37120 indicators.

"Climate change is real; it is happening right now. It is the most urgent threat facing our entire species, and we need to work collectively together and stop procrastinating. […] Let us not take this planet for granted."

DiCaprio, Leonardo. Oscar's acceptance speech. 2016.

Preface

This thesis is the final work of NTNU's MSc in Globalization, Politics and Culture program, and addresses the climate change policies implementation in Belo Horizonte. This thesis was supervised by John Eilif Hermansen and produced for the Department of Industrial Economics and Technology Management, NTNU.

My experience with Climate Change research goes back to my bachelor's, in which, under the supervision of my mentor Matilde de Souza, I had the opportunity to complete some research with a scholarship concerning Brazil and its positioning on the Climate Change regime. The interest in researching my hometown in terms of sustainable city arose as a sum of the rising engagement in multilevel governance and its process of internationalization. Also, the curiosity in researching sustainable cities is even bigger as a result of my experience of living in Trondheim, which has extensive accomplishments in the climate change policies itself. I thank to all my informants and interviewees that allowed this study to happen.

The road to this masters has been rough and I thank everyone who helped me on this journey, and I dedicate this thesis to you. Special thanks to my parents, Wander and Selene, my sister Marina and her husband Victor, who believed in this project and supported me emotionally and with resources. To my nephew and godson, Victor and to my niece Beatriz, I love you. To my grandmother Cleonice, who taught me how wonderful the world and knowledge are, inspiring me to keep exploring! To all in my big family, especially to my aunt Lili. To my friends Bruno Silva and Stephania Aleixo, who have helped me with their unrestricted support, patience, insights and their contribution to the studies. To the amazing friends in Norway who have been so supportive and without whose help I could not accomplish this; Rannveig, Pia, Josh, Taís, Caroline, Talita, Izabelle and Polyanna. Special thanks to Pedro Melo, who offered me his unconditional friendship on a daily basis, providing me lovely moments together and strength to keep on the right path. To Pål Jonas, who unconditionally loves and believes in me, and whose patience, love and affection teaches me every day. I would like to thank my supervisor, John Eilif Hermansen. Thanks to all friends and family who believed and supported me in this project, here in Norway, in Brazil and abroad.

Abstract

The rise of subnational governments promoting the climate change agenda introduces new scenarios, goals and challenges. In this thesis are addressed the challenges in planning and implementing climate change policies in Belo Horizonte, a big metropolis in Brazil. The city launched its local plan for reducing the GHG emissions encompassing low-carbon policies, PREGEE, pursuing the title of sustainable city. In this study its three main axes - transportation, sanitation and energy – are analyzed, according three category of analysis: local government capacity, local framing, and political actors and factors. The analysis was sustained by the data collection on documents and interviews, used to support stakeholder analysis and policy implementation theory. In this sense, this study investigates the challenges of implementing the low-carbon policies in Belo Horizonte's context and background, taking into account also the national framework for the climate change agenda. It is aimed to provide a better understanding on those challenges in order to promote a better path to low-carbon policies and actions' planning and implementation processes.

Keywords

Low-carbon Policies; Climate Change; Sustainable Cities; Multilevel Governance; Policy Implementation; Belo Horizonte; Brazil; Sustainable Development

Table of Contents

List of Figures

List of Tables

Abbreviations and Acronyms

ABNT	Brazilian Association of Technical Norms
BASIC	Brazil, South Africa, India and China
BH	Belo Horizonte
BHTRANS	Belo Horizonte's transport and traffic company
BNDES	National Bank of Economic and Social Development, Brazil
CBTU	Brazilian Company of Urban Trains
CH_4	Methane
CLIMAS	Climate Management System
CMMCE	Municipal Committee for Climate Change and Eco-efficiency of Belo Horizonte, Brazil
CNG	Compressed Natural Gas
CNPQ	National Council of Technological and Scientific Development, Brazil
CO_2	Carbon dioxide
COMAM	Municipal Council on Environment, Belo Horizonte
COP	Conference of Parties
COPASA-MG	Sanitation Company of Minas Gerais
CREA-MG	Regional Council of Engineering and Agronomy, Minas Gerais
FAPEMIG	Support Foundation of Research in Minas Gerais, Brazil
FEAM	State Foundation of Environment
FIEMG	Industry Federation of Minas Gerais State
FIFA	International Federation of Soccer Association
GDP	Gross Domestic Production
GGEOP	Geoprocessing Management, Belo Horizonte
GHG	Greenhouse gas
GPC	Global Protocol for Community Scale
GRI	Global Reporting Initiative
HDI	Human Development Index
HFC	Hydrofluorocarbon
IBGE	Brazilian Institute of Statistical Geography
ICLEI	International Council for Local Environmental Initiatives
IEA	International Energy Agency
iNDC	Intended Nationally Determined Contributions
IØT	Department of Industrial Economics and Technology Management
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
ISO	International Organization for Standardization
LDO	Municipal Directives for Budget, Belo Horizonte
LOA	Annual Budget Law, Belo Horizonte
LPG	Liquefied Petroleum Gas
MG	Minas Gerais
MMA	Brazilian Ministry of Environment

MRE	Brazilian Ministry of Foreign Affairs
MVW	Municipal solid waste
N_2O	Nitrous oxide
NAZCA	Non-State Actor Zone for Climate Action
NBR	Brazilian Norms
NGO	Non-governmental Organization
NTNU	Norwegian University of Science and Technology
OECD	Organization for Economic Co-operation and Development
OSCIP	Civil Society Organization of Public Interest
PAC	Growth Acceleration Projects
PBH	Belo Horizonte's City Hall
PBQP-H	Brazilian Program of Habitat Quality and Productivity
PEMC	Minas Gerais' Plan on Energy and Climate Change
PFC	Per fluorinated compounds
PlanMob	Urban Mobility Director Plan, Belo Horizonte
PNA	Plan on Climate Change Adaptation
PPAG	Multiannual Plan for Government Action, Belo Horizonte
PREGEE	Plan for Reducing the Greenhouse Gases Emissions for Belo Horizonte, Brazil
RIO92	United Nations Conference on Environment and Development – Rio de Janeiro, 1992
RMBH	Belo Horizonte's Metropolitan Region
SDG	Sustainable Development Goals
SEMAD	State Secretariat on Environment and Sustainable Development, Minas Gerais
SF_6	Sulfur hexafluoride
SINDUSCON-MG	State Union of Construction Industry, Minas Gerais
SLU	Superintendence of Urban Cleaning, Belo Horizonte
SMAGC	Municipal Deputy Secretariat of Shared Management, Belo Horizonte
SMAPU	Municipal Deputy Secretariat of Urban Planning, Belo Horizonte
SMDE	Municipal Secretariat of Development, Belo Horizonte
SMED	Municipal Secretariat of Education, Belo Horizonte
SMMA	Municipal Secretariat of Environment, Belo Horizonte
SMSA	Municipal Secretariat of Health, Belo Horizonte
SMSU	Municipal Secretariat of Urban Services
SUDECAP	Superintendence of the Capital Development, Belo Horizonte
tCO_2e	Tons of carbon dioxide equivalent
TRACE	Tool for Rapid Assessment of City Energy
UFMG	Federal University of Minas Gerais State
UHI	Urban heat island
UN	United Nations
UN Habitat	United Nations Human Settlements Program
UNFCCC	United Nations Framework Convention on Climate Change
UNOPS	United Nations Office for Project Services

Urban LEDS	Urban Low Emissions Development Strategy
URBEL	Belo Horizonte's Urbanization and Housing Company
VIURBS	Road Structure Program of Belo Horizonte
VNG	Vehicular Natural Gas
WG	Working groups
WRI	World Resources Institute
WWF	World Wildlife Fund

1. INTRODUCTION

At the verge of 2020 – the Kyoto Protocol's second commitment period and the implementation of Paris Agreement – Belo Horizonte, the third largest city in Brazil, is in the frontline of the sustainable development movement. Driven by the importance of the subject and the awareness of the local effects of climate change in Belo Horizonte and municipality, some actions towards climate change are emerging and becoming stronger than ever. The city is participating actively in international forums and meetings about the climate change issue and is taking part in the global efforts of climate mitigation. Nevertheless, it is important to analyze the development and implementation processes of those efforts. This study aims to fulfill this analysis and promote a better understanding of the challenges linked to policy development and implementation for climate mitigation in Belo Horizonte.

In the aftermath of Kyoto Protocol's conception, the discussion about climate change and the human impact on it were almost exclusively focusing on national governments' action. Currently, especially after Paris Agreement, the increasing rise of new actors – such as subnational governments, private companies and non-governmental organizations – is influencing the discussion and awareness of the need for subnational governments to adopt their own goals and targeted reduction of greenhouse gases. This engagement is important for the countries' targets, and collectively, can impact the global climate.

The concepts of Todaro (1981) and ICLEI (2016a) are used to explain what is understood as development of sustainable cities. Todaro (1981) *in* Leeson and Minogue (1988) refers to development as multi-dimensional process, in which involves the reorganization and reorientation of the entire economic and social systems. While ICLEI (2016a) defines as sustainable cities the ones in which work to achieve environmentally, socially and economically healthy and resilient home for the people, safeguarding the same or better conditions for the future generations. In this sense, it is understood the development of sustainable cities as the process of reorganizing and reorient the cities' economic and social systems in order to promote environmental, social and economic progress for a healthy and resilient home on behalf of the people and future generations. It is the responsibility of local governments to develop and implement policies in order to achieve the status of sustainable city, since the local government is the everyday front of the public sector and the level where the policy meets people. (World Bank, 2000)

On the local level, the relationship between climate change and people goes both ways, climate change is caused by and is affecting people's daily lives. According to UN Habitat (2016), cities are major players in the climate change considering that they are, despite covering less than 2 percent of the earth's surface, responsible for 78 percent of the consumed energy worldwide and for more than 60 percent of all CO_2 and other GHG world emissions. Yet, cities and people's lives are directly affected by the climate change effects, like rising of sea level, aggravation of precipitation, storms and cyclones, intensification of urban heat islands (UHI) etc. The aforementioned effects could impact negatively on the urban infrastructure and threat the access to basic urban services.

Therefore, it is important to raise awareness for the cities participating directly through actions of mitigation – to diminish the effects of climate change – and adaptation – to protect against its impacts. (UN Habitat, 2016). In this sense, this thesis aims to analyze the aftermath of the cities' commitment for mitigation and adaptation, more specifically, the development and implementation challenges for policies targeting climate change in Belo Horizonte. The city, capital of Minas Gerais state, Brazil, has already developed the 'Plan of Reducing the Emissions of Greenhouse Gases' (PREGEE). This plan, published in 2013, is a set of measures – organized in the axes Transportation, Energy, Sanitation and Waste, and Adaptation – to enable the reduction of GHG emissions with no harm to the city's economic development. As the plan fulfills the purpose of reducing the GHG emissions in Belo Horizonte, the PREGEE is the chosen unity of analysis of this study.

1.1. Background

The background was structured in the means of providing the relevant background for the development and implementation of low-carbon policies at the city level. First and foremost, the international framework for climate change policies is discussed briefly, highlighting the participation and contributions of Brazil. Then, the background for multilevel governance of climate change is outlined. This background provides basis for the discussion and argumentation in the following chapters.

1.1.1. Brazil and Climate Change

The Brazilian participation in the climate change negotiations goes back to its initial stages, hosting RIO92, the conference which established the UNFCCC (United Nations Framework

Convention on Climate Change). The following meetings under the scope of UNFCCC were called Conference of Parts (COP), in which several committees and work groups reunite and decide about the understanding of climate change, the risks involved, the measurement of GHG emissions and the actions for mitigation and adaptation, among others.

Brazil has been actively participating during the COP meetings by setting the tone for the discussion regarding the developing countries and acting as a mediator in the developed countries negotiations. The country, as part of the BASIC countries bloc (Brazil, South Africa, India and China), defends that the commitment for reducing the GHG emissions should be global, using joint efforts to achieve the targets to reduce the global emissions of GHG. However, the bloc believes that there must be differentiation between developed and developing countries on what regard the targets, based on the principle of economic development. In that sense, Brazil's position is that the country will do mitigation and adaptation efforts, but it is the developed countries' responsibility to take the lead on the commitment and implementation of absolute quantified emission reduction targets. (Brazilian Ministry of Foreign Affairs, 2016)

On April 22nd 2016, Brazil signed the Paris Agreement, wherein establishes the Intended Nationally Determined Contributions (iNDC) in which the countries commit individually and voluntarily with emissions reduction for the period of post-2020 (UNFCCC, 2015). The pre-2020 commitments were established by the previous agreement, the Kyoto Protocol, only for the countries listed in the protocol's Annex I (UNFCCC, 2016a). Moreover, according to the WRI (World Resources Institute, 2016) and UNFCCC (2015), a good iNDC should be built in a trustworthy environment, assured by the transparency of the design process of the commitment within all range of stakeholders. It is important that stakeholders, domestic or international, could track the progress and ensure the achievement of the target goal. Also, it is important to pursue a transparent communication within the domestic stakeholders in order to include them in the process of global emissions reductions and climate resilience in the future. In order to facilitate the implementation of policies, practices and actions for mitigating climate change according to each iNDC, the Paris Agreement states the importance of the non-Party stakeholders. The non-Party stakeholders encompass the civil society, the private sector, cities and subnational governments and authorities, local communities, financial institutions and indigenous people (UNFCCC, 2015). Their actions to mitigate, build resilience and decrease vulnerability to the adverse effects of climate change is an important tool to achieve the national commitments for emissions' reductions.

The Paris Agreement also reinstated the Non-State Actor Zone for Climate Action (NAZCA) platform (See in UNFCCC, 2016b), launched at COP20 in Lima. It is an interactive platform which registers non-state stakeholders (companies, cities, subnational regions and investors) commitments to climate mitigating efforts.

However, the agreement also addresses the need to incentive efforts to reduce emissions from non-state stakeholders. Those incentives could be in form of domestic policies and/or carbon pricing. This type of integration is needed due to the complexity of the climate change issue, an issue that overflows boundaries – a local emission can impact regionally, nationally and globally. And the global increase of temperatures impacts the micro level, the individual, people's lives. This issue permeates all levels of governance, it reaches all human beings, it impacts not only on the environment, but on the economic, political and social spheres. Currently, the commitments under the Climate Agreement are exclusively national, but it encourages the individual action, the local governments and stakeholders to protect our global common, the climate. During the COP meetings also occurs an ad-hoc group meeting, C40 cities. The group is a platform for exchanging experiences and sharing best practices on mitigation and adaptation in the city level.

The trend of non-state actors to take part in the efforts of climate mitigation is not exclusive to the climate change agreement. According to the Sustainable Development Goals, launched in New York in 2015, the role to promote sustainable development is not exclusive to national governments, but all different actors, such as regional and local governments. The role of local governments is far beyond to promote benefits locally, but has the power to spread policy trends regionally and nationally, helping to build a new agenda for a sustainable future. However, in order to have an urban agenda for climate, a multilevel governance with vertical integration is needed, with the incentive of participatory mechanisms, and this is not different in Brazil.

No information about the isolated percentage of urban emissions in Brazil could be found, nevertheless the urban emissions are a great part of global GHG emissions. According to IBGE (2016c) on 2010 census, the Brazilian urban population was 160.925.792, and the rural population was 29.830.007. In that sense, Brazil having a mostly urban concentrated population, cannot underestimate the impact of the urban emissions. Brazil recognizes the importance of the local governments' engagement for combating climate change and urges, through the national climate

policy, for the integration action between the local, regional and national spheres to achieve its targets. (Federative Republic of Brazil, 2015, Federative Republic of Brazil, 2009)

The national agenda for climate change has been confirmed, establishing the new national targets for reducing GHG emissions. Brazil have prepared and issued its iNDC before the COP 21, in September 2015. In this publication, the country commits to reduce its GHG emissions by 37% until 2015, considering the baseline scenario of 2005. Also, within the same baseline, the country commits to reduce by 43% the GHG emissions' levels in 2030. The country published their intended actions to reach this commitment by increasing the use of sustainable biofuels in the Brazilian energy mix and achieve 45% of renewables in the energy mix of 2030; act towards the problem of land-use change and forests, and implement low carbon emission practices in agriculture; setting standards for clean technology in industry; and promote the improvement in infrastructure for transportation and public transport in urban areas. Those intended actions are institutionalized under the Law which established the National Policy on Climate Change. (Federative Republic of Brazil, 2009) The policy institutes some directives to reach climate change mitigation and sustainable development, as the promotion of practices to reduce emissions and to stimulate sustainable production and consumption patterns. Following those guidelines, the Executive Power elaborates the sectorial plans for mitigation and adaptation to climate change, such as energy, industry, agriculture and transportation.

The policy has some execution instruments, such as the National Fund on Climate Change, the National Plan on Climate Change and the Brazilian Communication to UNFCCC. (Brazilian Ministry of Environment, 2016b) The National Fund on Climate Change is under the Ministry of Environment (MMA) umbrella. The fund is composed by two types of funding, the refundable and the non-refundable managed by the National Bank of Economic and Social Development (BNDES) and the MMA. The funds are gathered through the public budget and donations from national and international public or private organizations. The fund is directed to financing of climate change related projects and technical studies regarding climate Plan on Climate Change Adaptation (PNA) was released, considering 11 key sectors to fulfill the following goals: promote exchange and spread of technical knowledge; promote the coordination and control between the public agencies through participatory processes encompassing society; identifying and proposing new measures to adapt and lessen the associated risk to climate change. (Brazilian Ministry of Environment, 2016a)

Within the instruments to promote development in the country, one can support mitigation and adaptation efforts, the PAC – Growth Acceleration Projects – is a tool to finance infrastructural projects in cities and regions, in order to promote the accelerated and sustainable development. Currently, 119 projects in Belo Horizonte (or have Belo Horizonte in a crosscutting area), are financed by PAC, in various areas, but mainly in urbanization topics, such as sanitation and waste, transportation, urbanization of settlements, areas related to climate change mitigation. (Brazilian Ministry of Planning, 2016)

Having established a national framework regarding climate change, and the Inter-Ministerial Committee on Climate Change in the national sphere is already a step forward to achieve the intended reduction on emissions. However, as previously mentioned, those targets can hardly be achieved through the national government's actions without help, the joint efforts of the states (federative units) and the municipalities are necessary. And in order to achieve this vertical cooperation, there is a need to establish better multilevel governance mechanisms for climate in Brazil.

It is important to explain the type of government in Brazil, in order to understand the division of responsibilities between the federal units, municipalities and the national government. Brazil is a federal presidential constitutional republic, having the power divided into three branches, the executive, the legislative and the judiciary. The legislative power is composed by the Congress which is divided into two chambers, the Federal Senate and the Chamber of Deputies. The commitments made in international arena are defined by the Ministry of Foreign Affairs, once signed and ratified, the climate agreement are directed for the appreciation and approval of the Congress. Once approved in the Congress, in both chambers, presidential approval and ratification follows. By definition of the Brazilian Constitution, the national law only rules on general norms, competing the federate states and municipalities ruling about the regional and local interests and to be complimentary the federal legislation, in a vertical hierarchy. (Federative Republic of Brazil, 1988)

In this sense, following the Brazilian line of action, Minas Gerais, a state on the southeast region in Brazil, have already started to address the climate change problem. Several initiatives to reduce the GHG emissions according with both the National Plan and the National Policy on Climate Change have already been developed, such as the elaboration of the Regional Vulnerability

Study on Climate Change, the Regional Adaptation Strategy on Climate Change for Minas Gerais and the Minas Gerais Plan on Energy and Climate Change (PEMC). The state still does not have a law to rule on climate change, but several bills are in the process of voting and approval in the state legislative chamber. To elaborate the PEMC, efforts were made for data collection about the possible scenarios of consumption and production of energy and the state emissions of GHG for the years 2020 and 2030. The plan is under the supervision and scope of the Political Committee of PEMC in Minas Gerais. (FEAM, 2014a, FEAM, 2015, FEAM, 2014b, FEAM, 2016)

The need for consistent vertical actions for combating climate change is the confirmation that the climate change agenda, in terms of global mitigation, needs to focus in the urban agenda as well. Besides, there is no urban agenda without multilevel governance, vertical integration and participatory mechanisms. But Brazil still lacks mechanisms to integrate sub-national governments' efforts.

Therefore, it is important to analyze the local action for climate mitigation. Corroborating the multilevel governance for the climate trend, Belo Horizonte has voluntarily increased its efforts on mitigation, resilience and adaptation for climate change. The city, which participates in the meeting of C40 cities, already signed the Compact of Mayors, an agreement between the city governments around the world in order to combat climate change in a reliable and complimentary way to national efforts. The details of Belo Horizonte initiatives and the presence on international forums and governance mechanisms for climate change, are provided in Chapters 4 and 5. Those chapters provide the basis for the analysis of PREGEE's challenges, discussed on Chapter 6.

1.2. Purpose of the Study

This part is dedicated to presenting the research issue and the research questions, together with the relevance and contribution of the study.

1.2.1. Research issue and research question

This thesis has the main goal of analyzing the challenges on the process of planning and implementation of policies for mitigation and adaptation to climate change in Belo Horizonte, more specifically the PREGEE, in the light of the policy implementation theory, stakeholder analysis and the ISO 37120 – the international standard for sustainable development and resilience of communities –, in order to promote a critical reflection on the development and implementation processes of policies, actions, and proposals to mitigate climate change. In order to achieve the

intended goal, a question needs to be answered in the course of the study: what are the policy development and implementation challenges of the PREGEE in Belo Horizonte?

1.2.2. Relevance and contribution

The Brundtland Report already had addressed the importance of the cities as the means of deal the challenge of sustainable development. Furthermore, climate change is an environmental phenomenon with local causes with global consequences. The volume of GHG emissions and the local impacts of climate change are factors which pressure the subnational players to provide a more proactive and effective response. In addition, most of the local governments are responsible for defining and implementing local policy about issues deeply related with GHG emissions, then being capable to add the mitigation and adaptation to their political agenda (Rei and Cunha, 2011, van Staden and Musco, 2010). Gradually, local governments are addressing the climate change issues, through policies, programs and other measures. Also, they are not just growing in size and number, but gaining new influence (World Bank, 2000). However, in some cases, there is a gap between the policy discourse and the political reality for targeting the climate change (Ryan, 2014).

The factors and condition that shape policy making and policy implementation can differ from each case, being exclusive from that municipality. Therefore, the choice of location was due to my knowledge about the city and its urban environment, being a citizen of Belo Horizonte, born and raised there, providing me an insider perspective and insights of observation during the time I lived in the city. But more than that, the city has a growing presence in the international arena about the most diverse topics as a consequence of its internationalization project. And more specifically, Belo Horizonte, through its representatives, has been present in the latest meetings related to climate change, like the launch of the Sustainable Development Goals in New York 2015 and the COP21 in Paris 2015.

By analyzing the climate change policies and initiatives in Belo Horizonte, the study aims to shed light on the challenges faced during the development and implementation processes of mitigation policies and actions in BH. The choice of working with ISO 37120 is due to its purpose, being based on three pillars: *"a) measure performance management of city services and quality of life over time; b) learn from one another by allowing comparison across a wide range of performance measures; and, c) share best practices."* (International Organization for Standardization, 2014b) The standard for measuring some key indicators allows the tracking and

monitoring the progress of the city's performance on sustainability, helping, also, in the planning process for the future. The use of the standard would help to improve the monitoring of indicators, allowing to better planning processes for low-carbon policies and actions, supported by benchmarking comparisons.

More than just a case study, this research can get the attention of developed countries' researchers and institutions to the multilevel governance of development countries on climate change mitigation. This study can open doors for North-South paradiplomacy – the city level diplomacy, with its own purpose and interests, apart from the national diplomacy – and technical and financial cooperation in environmental and climate change areas. For NTNU and IØT, this study can corroborate to the pool of global knowledge on sustainable development, 'knowledge for a better world', that can share and spread best practices on city level climate change mitigation within the academic world.

1.3. Structure of the study

This thesis is divided into seven chapters, this Introduction being the first, presenting a macro background, the goals, research questions and the operationalization of the research variables. Followed by the second chapter, presenting the methods and tools used in this research. The third chapter presents the theoretical framework, with the necessary conceptualization and the literature review on policy implementation theory, the stakeholder analysis and the ISO 37120. In the fourth chapter, a more specific background on Belo Horizonte and how the city relate to the climate change issue is presented. In this chapter, the emissions scenario, the city's initiatives for mitigating climate change, the governance structure for the issue, the legal framework and the existing policies for climate change are explained. Also, the characterization of the stakeholders involved in the process of planning, monitoring and implementing the PREGEE is made. In the fifth chapter, PREGEE actions are analyzed according to the data gathered in the light of the theoretical framework, in order draw attention to the main challenges involved in the PREGEE planning and implementation processes. The chapter also discuss the use of benchmarking and some indicators of ISO 37120, that were related to the PREGEE actions and how the standard could help on measuring the city's progress on the transitional process to sustainable city, more specifically, in measuring the actions to mitigate climate change. Some recommendations are also made regarding the perceived challenges. The last chapter concludes this thesis, summing up the

topics discussed and the main findings, pointing out the weaknesses and obstacles of this research and proposing topics for further research.

2. METHODOLOGY AND TOOLS

This chapter describes the pool of the research design and methods used for this study, the tools used to identify the relevant data and literature and finally the ethical issues, reliability and validity of the research. Since it is a multidisciplinary research and given the research problem, the chosen methods relied on the qualitative approach.

2.1. Qualitative methods

First, it is important to state, that the research process is not given or static, and often needs rearrangements. Crang and Cook (2007), states that qualitative research is not a linear model (read-then do-then write), but a back-and-forth process between the basic steps: 1) Identify the topic; 2) Define a theory; 3) Plan aligning the methods and empirical approach; 4) Define the problem/question; 5) Data collection/production/construction; 6) Interpretation and analyzing. (Brun, 2015:12)

The first step was the attempt to gather a sufficient amount of primary data, such as news and articles and/or books about sustainable cities and multilevel governance of the climate issue. After that, some categorization of the data was made, in order to separate and schematize the reading and processing of that data. These steps provided a more solid background for the definition of the theme and research questions. Analyzing the data gathered, the theoretical framework was chosen, policy implementation theory, stakeholder analysis and ISO 37120, believing this set of theory and frameworks could, together, help the investigation. ANNEX IV is the summary of the methodological process, analyzing the theme according the framework, defining the category analyzed, its operational definition, the analysis units and the related indicators.

In the light of the theoretical framework and according the ANNEX IV, the set of data collected was analyzed and categorized, when some gaps were identified, such as the lack of internal information about the stakeholders and about the governance mechanisms and the policy making process regarding the PREGEE. In order to solve this matter, the choice of using interviews was made, considering the time-space constraint and limitations of this research – discussed with more details in the last subsection of this chapter. By using interviews and informal conversations with key stakeholders, another set of data was collected and categorized according to the methodology and the theoretical framework. The result of the data organization gathered with the interviews and informal conversations can be found on Annex II on the Stakeholders reference

matrix, served as the basis of the analysis. The analysis of the results was organized into a matrix in ANNEX I, crossing the PREGEE actions, PPAG actions and the related ISO 37120 indicators, which is explained with more details on Chapter 5.

2.1.1. Documentary research and literature review

In order to do documentary research, it is necessary to conceptualize a document according to the research questions framed. For some researchers, *"a document represents a reflection of reality",* for others, *"documents [are considered] as representative of the practical requirements for which they were constructed."* (May, 2001:182). In this sense, using the premises of policy implementation and stakeholder analysis, this study recognizes the latter definition.

It was necessary to gather a series of documents with the purpose of building a strong background on the proposed problem. This background, presented on both Chapter 1 and Chapter 4, serve as a starting point of my research and for applying the methods. It was a requirement to collect documents regarding the institutional background, the history and timeline of the climate change issue in Belo Horizonte, and some documents regarding the stakeholders involved in the issue. Therefore, two types of documents were used in this research: the primary and the secondary documents. The primary documents - or the public, officials, open source or restricted documents, made by governmental bodies or international organizations - represent the practical tools of Belo Horizonte for the climate change mitigation, such as the collection of federal, state and municipal laws regarding climate change, PREGEE, the Governmental Program and PPAG. Also, GHG emissions inventories and census produced by a research institute and/or private companies were also used. In this sense, it is important to acknowledge the documents according how authentic, representative, credible and meaningful it could be. (May, 2001). In this specific research, the documentary research relied mainly on official documents, characterizing this as one of the limitations of this study. Therefore, some critical reflection on the reliability and validity is needed. This study focus on researching the challenges regarding the PREGEE, a document that plans on reducing the GHG emissions in Belo Horizonte, being a report built in cooperation with several stakeholders and being monitored by a committee created for discussing the climate change matters in Belo Horizonte, CMMCE.

Secondary documents, documents with treated data (not raw), such as technical reports, articles, researches and publications regarding the multilevel governance of climate change and the

emissions scenario of Brazil, Minas Gerais and Belo Horizonte, were also used. After the document assembly, a literature review was conducted about the theme and the chosen theoretical framework. The literature review required classification and organization methods for the data and the documents gathered according to the theme and local studied. A sort of speed-reading helped at first on the classification of the articles and books, in order to tag them according to subject and data provided.

After the literature review and while conducting the interviews, the PREGEE was analyzed and had its actions categorized and cross-analyzed with the actions on PPAG, its initial budget and the public results. Its actions were also classified according to the ISO 37120 indicators which could be affected by that action. Since the plan does not encompass all the indicators of this standard, only the relevant indicators were used. The result can be found in ANNEX I, organized according to the PREGEE's actions. ANNEX III provides the full text of the ISO 37120 indicators as well as the PPAG programs. It is important to state that documentary research and literature review are supporting methods to the core methods in this research, which is interviews.

Relevant literature

As stated previously, the gathering of official documents concerning and related to the climate change issue is crucial for this research. Extensive research on the internet was preformed, and some key documents were selected, such as the city budget plan, the government plan, inventories on GHG emissions and the PREGEE itself. Some key informers provided non-public policy clippings about these documents that were used to present the mitigation initiatives in international meetings and forums.

Another extensive research for existing literature about the theme was conducted using Scopus and Google Scholar with the support of the NTNU network and access to journals and publications, and Scielo Brazil, an academic research tool for Brazilian publications. Keywords such as multilevel governance, climate change, paradiplomacy and policy implementation were used. The literature found was classified according to the subject and in which part of the study would be relevant, making the process of reading easier. The guiding literature for this study were Ryan (2014), Ryan (2015); Betsill and Bulkeley (2006), Bulkeley and Betsill (2005); World Bank (2016), World Bank (2000); International Organization for Standardization (2014b); van Staden

and Musco (2010). From this starting point, supporting literature review and research were made. The complete list of literature used can be found in References.

In order to pursue a strong and unique basis for this study, there was an attempt to obtain exclusive updates of the GHG report and the PREGEE from the company that was hired to elaborate the city reports and plan. However, given the short time for this research and the slow bureaucratic processes in governmental bodies, this was not possible. Some internal private documents regarding the CMMCE and PREGEE were also accessed, providing a different perspective on the results. It was granted exclusive access to ABNT working group on ISO 37120 members, reports and results. The working group is translating the ISO 37120 and adapting to the Brazilian reality. The private documents were not used in this research, but provided a different understanding of the governmental work and position regarding climate change.

2.1.2. Interviews

Interviews are usually a good method to collect impressions from an individual or a group of individuals. As a main method to support the stakeholder analysis, interviews are used to understand the position, feelings and impressions of individuals, it also helps to understand people's context. Interviews can be structured, semi-structured or non-structured; formal or informal; and directed to one individual or more (in the case of focus groups). The interview is often used combined with other methods, and the participant observation can provide the researcher different angles to reflecting on the interview's results (May, 2001). The interview processes were organized in the following steps: 1) thematizing (delimitation of the problem, building the knowledge base); 2) operationalizing (work within the theoretical framework and concepts); 3) sampling (select the relevant group of *participants*); 4) build an interview guide; 5) transcription and interpretation of the data.

2.2. Research model and operationalization of the data gathered

The interviews in this study were conducted with some key stakeholders. Corroborating with Crang and Cook (2007) assumption that the research process is not static, some previous use of the stakeholder analysis was needed, in order to sample the key stakeholders. However, the analysis was already made by the local government, in order to choose the components of the CMMCE. Therefore, the sampling method was to consider stakeholders related to the issue, being a part of the CMMCE or mentioned as relevant by informants. The committee, which is explained

with more details in the following discussion and background, is a multi-stakeholder platform to discuss, elaborate and follow up actions and policies targeting climate change. The data regarding the individuals who constitute this committee were categorized according the stakeholder analysis premises.

The stakeholder analysis based on World Bank (2016) – discussed in more details in the Theoretical Framework – suggests to organize and classify the data according to the relative power/influence and salience each stakeholder possess. The classification of the stakeholders can be done considering the salience/interest of the stakeholders according the following categorization: a) Promoters; b) Defenders; c) Latents; and d) Apathetics. As suggested by the World Bank (2016), a way to operationalize the results gathered from the interviews is cataloging and organizing in charts and/or matrices by the following criteria: 1) group; 2) their interest; 3) range of influence (power); 4) position on the issue. It is important to think about the degree of power the stakeholders possess. The degree of effective power can be determined combining the stakeholder's salience and influence, information intended to be collected through the interviews and personal observations. The stakeholders were organized into groups and coalitions to facilitate the analysis due to the large number of stakeholders and the time-space constraint to conduct interviews with all, selecting just some individuals through a sampling process. The organization of the stakeholders within the CMMCE is public as states in the Table 1. The results of the interviews provided data to fulfill the matrix, with direct information or through data interpretation, and sometimes, in the lack of concrete information, some assumptions were made – those are marked as in the comments box.

Table 1 - Sitting and alternate members of CMMCE

Stakeholder	**Name of the representative and position**	**Group/Coalition it belongs**
SMMA	Weber Coutinho (sitting member) and Ana Vitoria Wernke (alternate)	City government
SMSA	Marco Aurélio Carabetti Diniz (sitting member) and Rosângela Durso Perillo (alternate)	
SMED	Cristiano Oliveira Castro (sitting member) and Amarildo Antônio Ferreira (alternate)	
SMSU	Paulo Freitas de Oliveira (alternate)	
SMAPU	Guilherme Pereira Vargas (sitting member) and Tiago Esteves Gonçalves da Costa (alternate)	
SMAGC	Diego Ferreira Fonseca (sitting member) and Liliana Gomes Rocha Sousa (alternate)	
SUDECAP	Ilda Maria Carvalho Aguiar (sitting member) and Carlos Alberto dos Santos (alternate)	

SLU	Sandra Machado Fiuza (sitting member) and Wadson Vieira Dias (alternate)	
URBEL	Andrea Scalon Afonso (sitting member) and Kelle Cristina Moreira de Oliveira (alternate)	
BHTRANS	Marcos Fontoura de Oliveira (sitting member) and Helio Geraldo Rodrigues Costa Filho (alternate)	
City Council	Councilman Sergio Fernando Pereira de Pinho Tavares (sitting member) – Francisco Jorge; and Councilwoman Elaine Matozinhos (alternate)	
SEMAD	Janaina Maria Franca dos Anjos (sitting member) and Felipe Santos de Miranda Nunes (alternate)	State government
COPASA-MG	Andressa Regina Batista Drumond (sitting member)	
CEMIG	Adiéliton Galvão de Freitas (sitting member) and Julio Cesar Ezequiel da Costa (alternate)	
FIEMG	Breno Aguiar de Paula (sitting member) and Wagner Soares Costa (alternate)	Civil Society: Industry representative
SINDUSCON-MG	Eduardo Henrique Moreira (sitting member) and Fernando Sérgio Fogli (alternate)	
CREA-MG	Fabiano Baroncelli (sitting member) and Fernando Augusto Villaça Gomes (alternate)	
Centro Universitário UNA	Elizabeth Marques Duarte Pereira (sitting member) – Luciana Penha (representative)	Civil Society: University
UFMG	Gilberto Caldeira Bandeira de Melo (alternate)	
PontoTerra	Ronaldo Vasconcellos Novais (sitting member)	Civil Society: NGOs
Nossa Bh	Guilherme Lara C. Tampieri	

Source: Prefeitura Municipal de Belo Horizonte (2016b)

The semi-structured interviews were the choice of method in this study. The first interviews guides were prepared in a way of provide the same questions for every interviewee. First, the interviewees were contacted by phone, and had the research, the main objectives and part of the methodology used explained. The interview guides were mostly sent by email, as were the answers received. This provided a common ground to work on. Following the answers to the structured guide of questions, some unstructured questions were asked, trying to gather most of the data which were not covered by the first set of questions. In this phase, the questions were individually directed and unstructured, mostly sent and answered by email, but also through phone calls and informal text messages. There were a total of 11 different people contacted, and only 9 respondents through email and phone calls. The results of these interviews will not be attached to this thesis, the sources were treated as anonymous, except in specific cases and only with their express authorization. The set of structured questions on ANNEX V.

The analysis of the data gathered in the interviews followed the framework of policy implementation and stakeholder analysis. The operationalization of the variables and methods is explained in the next subsection. It is important to state that during the whole process of interviews

there was a reflection about the positioning of the researcher in the context of the interview, which is discussed in depth in the section *Ethical issues, reliability and validity of the study*.

2.2.1. Operationalization of the variables

The research questions are intended to provide indicators that could be organized into four main variables, in which I intend to operationalize according the following figure:

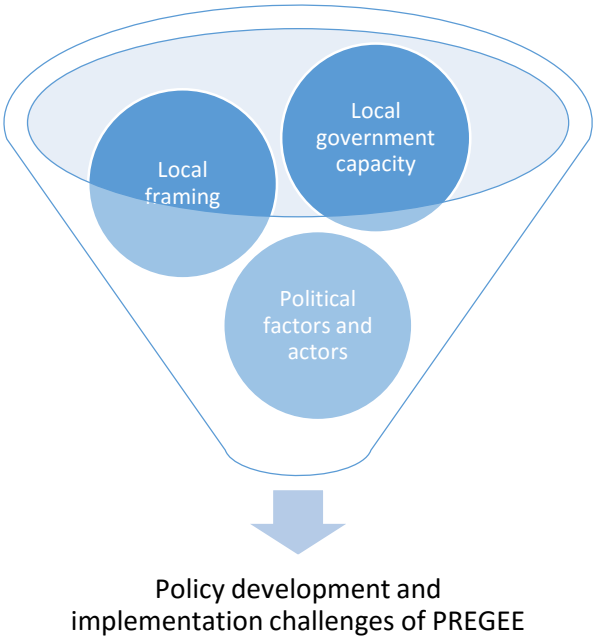

Figure 1 - Operationalization of variables
Source: Own elaboration

The variables are organized in the means of listing and understanding the design and implementation challenges of the PREGEE with the help of implementation policy theory and stakeholder analysis. The implementation policy provides a framework of analysis in three areas: 1) local government capacity; 2) local framing; 3) political factors and actors. It was expected to map the stakeholders' interests and power regarding the climate change policies in Belo Horizonte, and the implementation challenges related to the three related areas aforementioned, through semi-structured interviews.

As the analysis category for the local government capacity are analyzed the legal capacity and the financial and organizational resources, represented by the analysis units: the municipal legal framework, PREGEE financial structure and governance, and governance structure for climate change in Belo Horizonte. The indicators for those analysis units are: Existence of laws

institutionalizing the PREGEE and its proposals; existence of federal and/or municipal budget for implementing PREGEE; existence of qualified personal within the governmental agencies ahead of main PREGEE axes and/or specialized departments.

For the local framing, the analysis categories are how the society relate climate change with the local problems and if the society perceive the socio-economic advantages and environmental welfare of actions to mitigate climate change. This perception was checked through the interview process and its analysis units were: educational and awareness campaigns; municipal school syllabus; voluntary action for mitigating climate change. Those units were measured according to the existence/number of campaigns made by or supported by the government to raise awareness to climate change and the need for sustainable development; the presence of climate change subject in the municipal school syllabus; existence of any voluntary direct or indirect action to mitigate climate change.

Regarding the category of political actors and factors, three main analysis categories were considered: political entrepreneur; influence of interest groups; and the role of political parties. The analysis units were: Government plan of current mayor and the presence of a political representative in international forums about climate change; CMMCE stakeholders; City Council members on CMMCE and their participation. Those units are represented by the indicators: Position regarding climate change on municipal and international levels; perception of power relations within the committee; counselors' mitigation projects at City Council. The organization of those analysis levels and units can be found on ANNEX IV.

2.3. Ethical issues, reliability and validity of the study

It is important to discuss the ethical issues regarding the chosen methods and the research itself. A current discussion regarding the researcher, is its positionality and the power relations he/she is inserted when doing the fieldwork. According to Brun et al. (2013), the field is a web of complex power relations, which affects how researchers perceive their position.. The researcher has a specific power in the field, he or she usually defines the course of the research and define the field itself. (Katz, 1994) In interviews, the researcher has the power to choose the questions, the way to conduct the research and often guide the interviewee to a specific result. However, Rose (1997) argues that this positionality is not static, but it depends on the context, audiences and demands. It is important to state that the field of this research was characterized by the city, Belo

Horizonte, in which the informants and interviewees were based. However, the research was entirely conducted based in Trondheim, through the internet and phone.

Additionally, the researcher and the interviewees are not exempt from their backgrounds. Thus, both are deeply embedded in multiple contexts, cultures, genders, nationalities, and several identities (Crang and Cook, 2007). Therefore, recognizing the subjective atmosphere in which each individual is inserted can help the researcher to consider different colors in the impartiality and neutrality in the qualitative research. The interview guides were sent to interviewees requesting their positions in each organization they represent inside the CMMCE, also, some information about their background and beliefs were collected during the phone calls and email exchanges. Apart from that, given that there were no opportunities to do a practical fieldwork and be in direct contact with them, a personal observation of the individual was not possible, this being one of the weaknesses of the study.

It is important to do a continuous process of critical reflexivity, which can be defined as *"a process of constant, self-conscious, scrutiny of the self as researcher and of the research process"* (England, 1994 in Dowling, 2000). During the whole process of this research, I have tried to maintain impartial given my political views and individual characteristics. Connected to the critical reflexivity is the ethical discussion. *"Ethics is concerned with the attempt to formulate codes and principles of moral behavior."* (May, 2001:59) During this research, I have tried to be impartial during the phone contacts and in the elaboration of the questions. Also, during the interpretation of the data, I did not use any kind of discourse analysis, but I relied on the facts and information provided by the interviewees, and on my personal observation of the political scenario and organization in Belo Horizonte during the time I lived there.

The way the interviews were conducted, through email and phone contacts, the power relations were inverted. Despite usually the researcher having a relevant power to the interviewees, the way this research was conducted, the power was in the hands of interviewees. This because they could control and review their answer before send me it back through email. This was not perceived as an attempt to hide or regulate the results, but most of the times, the political stakeholders have an agenda that they want to promote.

Additionally, it is needed to consider the ethical issues with conducting interviews and fieldwork, having responsibility to the material produced and the anonymity of the interviewees, if

they require. In this research, along with the interview guide, a *Consent Form* was sent and explained, with the definition of the research and the main goals of using the answers.

According to Bryman (2016:41,158), the validity of the study presumes the reliability of the same. The author defines validity as *"the issue of whether an indicator (or set of indicators) that is devised to gauge a concept really measures that concept*" and reliability as *"the degree to which a measure of a concept is stable"*. Therefore, the indicator cannot be valid if it is not reliable. The collection of data through interviews, to feed the stakeholders matrix and to establish a ground on the analysis, was made in the effort to confer validity and reliability to this research. However, it is important to stress that the validity of the study can be impacted by the fact that, since the PREGEE being in an ongoing process of formulation and implementation and the study relied on the interview data, complex information was difficult to be disclosed by the interviewees, who have agendas. Also, considering that some facts and indicators were only supported by the data collected through interviews, the stability of these can be criticized, and thus, the reliability of the study can be as well.

2.3.1. Limitations

The main limitation to this research was the space constraint. Conducting a research on a different site, in a different country, is challenging. Due to lack of resources – and the high logistic costs that it would incur to do otherwise – this thesis was mainly based on internet research and calls through the internet. Because of this limitation, the research relied mostly on official public data, which can be partial and not provide the complete set of information the related governmental body holds.

Another important limitation was the time constraint. The time difference between Trondheim and Belo Horizonte made some phone calls difficult due to the working hours at public offices in Brazil of many times. Also, the period given for data collection and writing was only six months. Ideally, this project should start with the internship initiative and experience I had during fall of 2015. However, the subject researched during the internship – hydropower development in Brazil – has already been extensively researched, and is thus not an attractive subject for my master thesis. This constrained also the possibility of deeply investigate some of the analysis units, such as the municipal school syllabus, the existence/number of awareness campaigns for climate change and the participation of city counselors on the matter.

Additionally, the permeability of the governmental bodies, non-governmental organizations and the private companies involved with the PREGEE and the CMMCE was another issue to face. Some individuals contacted were not interested in collaborating with this research, others did not want to answer the questions regarding the challenges involved. Another constraint is the agenda of some stakeholders, which influences their answers and their decision on not to answer the interview guides and cooperate with the study. Nonetheless, there was an overall interest in this research of key stakeholders inside the committee, hoping that this outsider perspective would give them a different sight on their challenges and options to overcome it. Some of the analysis units could not be deeply investigate

Some of these challenges could be solved if the research was physically conducted in Belo Horizonte. Therefore, it is believed that if the period of research was larger, and if there were funds for researching in field, the study could be more insightful and provide a deeper analysis of the planning and implementation of low-carbon policies in Belo Horizonte.

3. THEORETICAL FRAMEWORK

3.1. Key concepts and assumptions

In order to understand this analysis, it is important to define some key concepts. The first important concept to be defined is *Sustainable Development*. As pointed out in the *Introduction*, the term has been constantly discussed and changed over time, but the Brundtland Report definition is one of the most popular and widespread, dated to 1987. The concept is defined as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs."* (Our Common Future, , 1987) embraces the economic aspect of development on the present and how this could be sustained in the future. During the United Nations Conference on Environment and Development in Rio de Janeiro on 1992, this concept was the solid base in which the Rio Declaration on Environment and Development was built. The declaration, in its very first principle, acknowledges the human beings as the center of concerns on sustainable development. More than that, it recognizes *"the right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations."* (Principle 3 on Rio Declaration on Environment and Development, , 1992). The concept has been reshaped ever since, but the definition by Griggs et al. (2013) better serves the purpose of this study in embracing the three most important pillars of our modern world: economy, environment and society. Conceptualizing sustainable development as "*development that meets the needs of the present while safeguarding Earth's life support system, on which the welfare of the current and future generations depends"* puts the Earth's life support system, together with human beings, as the center of the concern. The Earth's life support system is composed of the atmosphere, oceans, forests, waterways, biodiversity and biogeochemical cycles. In this regard, this concept also provides a better understanding on the environmental pillar.

Serving as a base for the SDGs, the Rio Declaration, in its 5th principle, recognizes that all states and all people shall cooperate to eradicate poverty, this being vital for achieving sustainable development. Also, in principles 10, 20, 21, 22 and 27, the declaration urges the involvement, contribution and participation of individuals, together with the nation-states to achieve sustainable development. (United Nations, 1992) All those principles served as a base for the acknowledgement of the role of different actors, such as local governments, to promote sustainable development under the Sustainable Development Goals umbrella. Specifically, Goal 11 states about the need of making cities inclusive, safe, resilient and sustainable. In between its targets, the

relevant ones for the topic of climate change are: providing better and sustainable transport systems; increase the resilience against disasters; better and inclusive sustainable urbanization; reduce the adverse environmental impacts, especially on air quality and waste management; support the least developed countries with sustainable and resilient building practices through financial and technical aid. (Sustainable Development Goals, , 2015)

Concerning the international framework for climate change, the role of local governments is far beyond promoting benefits locally. It also has the power to spread policy trends regionally and nationally, helping to build a new agenda for a sustainable future. The rise of sustainable cities is a growing trend worldwide. But what are *Sustainable Cities*? According to ICLEI (2016a) *"sustainable cities work towards an environmentally, socially, and economically healthy and resilient habitat for existing populations, without compromising the ability of future generations to experience the same."* Through the multilevel governance of low-carbon policies by sustainable cities, the climate change issue can be better addressed. By *governance*, we borrow the definition from ISO 18091:2014, which is the *"legitimate, responsible, accountable and efficient activity of governing a society by itself and through its own government."* (International Organization for Standardization, 2014a) Therefore, *multilevel governance* is understood as not only the governing through coordination and regulation of politics by the political actors and factors, but also the articulation and the cooperation standards in between those. It is important to say that the political actors and factors are not just the traditional mechanisms of interest articulation, such as political parties and pressure groups, but informal social networks and other associations of diverse type (Hollingsworth, Schmitter e Streeck apud Melo, 1995 in Santos, 1997) By *low-carbon policies* we understand as the actions, strategies and policies that encompass low-emission and/or climate-resilient economic growth. (OECD, IEA, 2010 in United Nations, 2016)

As the object of study of this research is the PREGEE and the effectiveness of its developing and implementation processes, it is necessary to conceptualize the terms for effectiveness, the development and implementation of policies. Effectiveness is, according International Organization for Standardization (2014b), *"the extent to which planned activities are realized and planned results are achieved.".* As for policy development is understood the process of planning, formulation and developing, as well as the monitoring and all foregoing processes from policy implementation of action plans on climate change. As for *implementation*, the research borrows the concept from Ryan (2015) *"as the actions taken by governmental actors to carry out a public*

policy decision", meaning to translate the public policy into concrete and operating actions. Also, it is necessary to stress that policy adoption, on what concerns this research, does not have the same meaning as policy implementation. According to Sharp and others in Ryan (2015), the adoption of climate programs or enacting climate mitigating legislation at the city level is normally not very politically controversial. This particularly happens when those legislations only indicate generalized commitments and aspirational goals regarding the programs. Yet, policy implementation is through concrete actions from the government, which can be highly controversial, creating disputes with the government organizational and economic resources. During the policy implementation it is possible to observe if the climate policies and actions are essentially rhetoric or are intended to be put into practice. In this sense, the policy implementation theory supports this analysis.

3.2. Policy implementation at city level

For doing this analysis, I went through literature regarding policy implementation at city level, but specially directed at climate change policies. The multilevel governance importance and the challenges of policy implementation are not new subjects for the social sciences. However, the specific discussion regarding climate change policies is a relatively new field, since cities are increasingly starting to build their individual GHG emissions inventories and climate change policies.

Ryan (2015) provided a literature review on climate policy implementation at city level and compacted the most relevant conditions for climate policy implementation into three sets: 1) Local government capacity; 2) local framing; and 3) political factors and actors. According to the author, the sets of conditions do not have equal weight on climate change policy of every city context, rather is specific for each one. In this sense, for a better analysis of policy implementation, it is necessary to assess each case specifically, according to these three sets of conditions.

First, the *local government capacity* should be assessed in regard to the government legal capabilities, and financial and organizational resources – such as human resources, funding and information management. The **legal capacity** can be measured with an analysis of the municipal governance arrangements. Governments that control and regulate key policy sectors such as energy, waste, transport and planning, are more likely to develop climate change policies and initiatives. However, in large urban areas or metropolis, is common to have multiple jurisdictions

and levels of government attached to those key sectors. In those cases, the ability of formulate and implement climate change policies will depend on each municipal governance arrangements. The **financial and organizational resources** can be interdependent. The lack of funding, for example, can affect the capacity of hiring staff to address climate change, affecting, thus, the access of complex and crucial information about local climate change impacts, vulnerability, methods for mitigation and targeting and more.

Then, it is important to evaluate the city according to its *local framing*, or the ability of the government and the society to frame the climate change policies **related to local problems**. Furthermore, the understanding of how the climate change policies will **generate socio-economic or environmental welfare** can directly impact in the effectiveness of the policy. Therefore, in some cases, policies are not directly targeting climate mitigation, but other crucial issues, like the improvement of sanitation, public transportation and access to energy, can be more effective than just advisory-like climate change policies. The local framing is also attached to the need for the municipal governments and the society to link the climate change goals with more practical issues of their daily lives. The linkage of a climate change policy with local concerns and interests can also affect its effectiveness. Therefore, it is important to involve the civil society in the process of policy making, in order to bring their attention to the subject and to transform it into something applicable to their everyday life.

It is equally important to evaluate the city capacity on what concerns *political factors and actors*. First of all, it is important to understand the role of the political leadership, or the **political entrepreneur** that engage to promote the climate change agenda. Often, the political entrepreneur can be represented by senior local government officials, either for ideological reasons or to advance their careers. In order to support the entrepreneurs with reputation enhancement and/or access to technical information, it is necessary to engage in transnational networks, such as ICLEI and the C40. However, the capacity of the entrepreneurs can be affected by the political and institutional arrangements – given the common political difficulty and costs associated to climate change policies. The political actors should be analyzed according to the **influence of interest groups** and the **role of political parties**. First, the social coalitions can both support or oppose to the climate policies. The degree of participation and their ability to lobby their local government regarding the issue can directly impact in the effectiveness of the policy implementation. Also, the interest of the political parties and, therefore, their agendas is another factor that can affect the implementation of

climate change policies. Therefore, it is important to acknowledge that the social coalitions and the political parties – important actors or stakeholders –, their involvement and their interests are shaped by and shape the level of politicization of climate change issue.

3.3. Stakeholder Analysis

In order to support the analysis of the variables of policy implementation theory, the study also relied on the Stakeholder Analysis. The stakeholder analysis as a theory has its roots on R. Edward Freeman in the 1980s with a more business driven approach. Since then, a considerable expansion of its usage to fields such as strategic management, corporate social responsibility, game and decision theory, political economy, environmental sciences and others. The stakeholder analysis is an important tool for multilevel governance. Involving stakeholders in public policy and the dialogue with the interests of the society is important to understand in details the individual views concerning what is agreed in international arenas (Midttun, 2009). Stakeholder analysis aims to help to specify who are the stakeholders, their role in the process of policy making and the impact of this influence.

Consequently, it helps to delimitate the answers of policy and other actors on the latter. Currently, the World Bank (2016) organized their understanding of stakeholder analysis based on Bianchi and Kossoudji (2001), Brinkerhoff and Crosby (2002) and previous own publications. The bank advises to use the analysis in order to enable institutional and reform policy processes, for involved to attain the needs of those who have interest in that. That is because by establishing the stakeholders' interests and their capacity to oppose reform they can impact in the overall result of the implementation.

In this regard, the climate change issue, which affects and is directly related to the individual action, should be, in theory, a topic of overall interest. The truth is, however, that the topic is still underestimated and underrated by some of the political actors and other stakeholders. That is because the understanding of the urgency in the mitigation and adaptation to climate issue have still not reached the core of policy making processes worldwide. Therefore, there is a need to make the institutional and reform policy processes on climate mitigation and adaptation issues. As mentioned before, Belo Horizonte already acknowledge the importance of the issue and is already planning political actions for mitigating and adapting to climate change. Hence, the choice of this

theory for analyzing this reform process. The goal is to know how the stakeholders can impact the planning and implementation processes of PREGEE and the challenges related to the latter.

But first it is important to define what stakeholders are. According to World Bank (2016), they are political actors or political entities that have interest in some political agenda. They can be individuals, organizations or groups. In order to provide a start for the analysis, the first step is defining who the stakeholders involved in the PREGEE planning and implementation are. As stated in the *METHODOLOGY AND TOOLS* chapter, the sampling process of the stakeholders for this study was made according to the choice of stakeholders to participate on the CMMCE.

After defining who are the stakeholders for the study, it is necessary to understand how they organize and relate to each other, and most importantly, to define what their interests and their influence on the reform policy are. The World Bank (2016) states that stakeholders must be categorized and analyzed according to their group, interest (or salience), influence (power) and position on the reform. Also, they must be classified according to their *effective power*, or *"the degree of power the stakeholder holds over other groups in relation to a reform area"* (World Bank, 2016). The measurement of their effective power is given by evaluating the combination of their salience (interest) and influence (power). They can be classified under four categories: promoters, defenders, latents and apathetics. The *promoters* are stakeholders who has the reform policy in high account and whose actions can impact directly on the implementation of the policy, meaning high salience and power. The *defenders* are the ones who attribute high priority to the reform policy – high salience – but cannot significantly impact on the implementation of the policy – low power. The *latents* are stakeholders in which can affect the implementation of the reform policy – high power -, but confer small importance to this policy – low salience. And last, the *apathetics*, the ones whose actions cannot impact the implementation or confer importance to the reform policy. Figure 2, illustrates better the power x salience ratio according to World Bank (2016) classification.

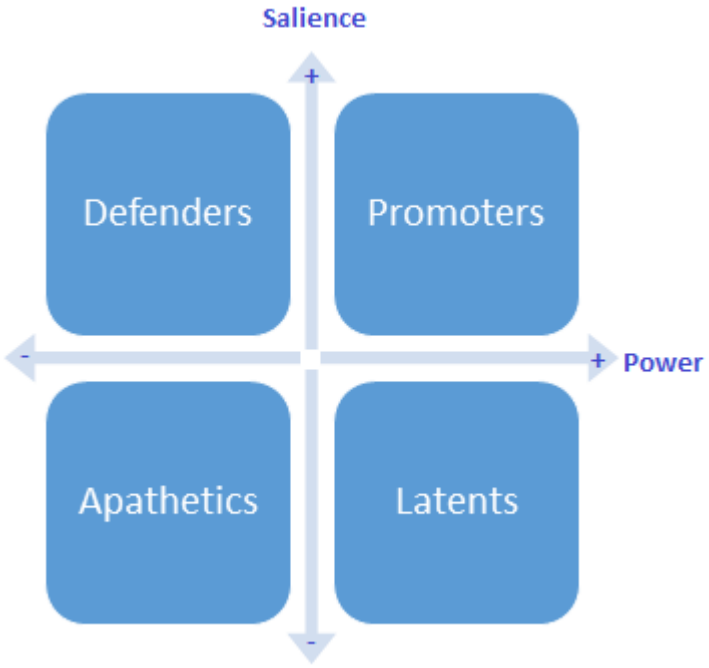

Figure 2 - Stakeholders effective power
Source: Based on World Bank (2016).

This categorization enables the construction of the scenario in which the PREGEE is inserted. It also helps to determine some responsive strategies, like which stakeholders are more likely to help the planning and implementation and which stakeholders could impose a challenge for it.

Whereas the categorization determines the stakeholders' interest and power, the stakeholder analysis needs supportive tools to be operationalized. As stated in the methodological chapter, and in accordance to World Bank suggestions, interviews are used to help this delimitation. The semi-structured interviews were focused on the stakeholders' background information about PREGEE and their participation on the CMMCE. It is important to state that the stakeholders' position may vary over time and the course of the planning and implementation.

In compliance with the World Bank suggestions, another source for this study was the unstructured talks with some municipality team members and members of the private company involved in the elaboration of the first emissions inventory for Belo Horizonte (non-CMMCE

members). This tool was important for this study since those individuals often grasp wide local knowledge and are able to impart about critical first hand understanding of the issue.

Dialoguing with the policy implementation theory previously presented, the delimitation of the stakeholders' interests and power aims to find the challenges concerning the design and implementation processes of PREGEE. The stakeholder analysis provides more than the stakeholders effective power, but also relevant information for the stakeholders involved on negotiation strategies with opposing stakeholders. After the definition of the information about the stakeholders and their positioning according to the PREGEE design and implementation, it is possible to better choose their course of action and to make sure that the policies are adopted in a politically realistic and sustainable way. (World Bank, 2016)

3.4. ISO 37120

To support the analysis of effectiveness of planning and implementation of climate change policies, the ISO 37120 – the standard for sustainable cities – helps to analyze the performance of Belo Horizonte regarding its actions on the PREGEE in a measurable way. The standard released on May 2014, was chosen given its universality of application at the municipal level. The goal to use measurable indicators is to *"facilitate and promote the integration and interoperability of city systems to provide better and more efficient city services to citizens and businesses while promoting sustainable development."* (International Organization for Standardization, 2014b)

The Brazilian Association of Technical Norms (ABNT), a private organization that provides rules and standards for a wide range of issues and products, has established a special commission for studying of sustainable development in communities, where it aims to set up rules and standards for terms, requirements and procedures regarding sustainable development in communities, focusing on quality of life, infrastructure and public services. This commission is based on the ISO 37120. Therefore, this methodology is not only applicable for Brazilian cities, but it is also being used – translated and adapted to the Brazilian reality, without changing the ISO standard - by ABNT. During this research, I had access to the undisclosed preliminary documents of the translated standard, as well as to the meeting reports and contacts of the people involved in it. The process of translation of the standard is still in course, making it difficult to be adopted by Brazilian municipal governments.

The standard is designed to target sustainable development in cities, in order to provide indicators to measure cities' performance. It is designed to be a uniform approach to what is measured and not to provide a value judgement. ISO 37120 is not designed to provide a certification, just a standardized measurement for city services and quality of life, aiming to help cities to measure their performance, enabling to learn with other cases by comparison and share best practices. The standard is divided into core and supporting indicators. Core indicators are the indicators that are crucial for measurement when adopting the standard and are a requirement, and supporting indicators are the ones that important, but not crucial, for the measurement and are recommended. The standard also offers a set of profile indicators that provide basic statistics and background information in order to enable the comparison. It is required that the indicators would be compiled on an annual basis. (International Organization for Standardization, 2014b)

It is also important to acknowledge the potential effects of the outcome of the indicators, such as the increasing of emissions when having the number of automobiles, e.g. In order to interpret the data, the city have to take into account the local institutional environment and governance mechanisms. (International Organization for Standardization, 2014b) The standard is divided in 17 clauses or main areas that comprises 46 core indicators and 56 supporting indicators. The description of the areas and indicators can be found in ANNEX III. Currently, there is an interactive, online and open tool to explore, track, monitor and compare cities that applied the standard according to the performance and quality of life indicators, called World Council on City Data – Open Data Portal, that can be accessed on http://open.dataforcities.org/. Presently, there are 29 cities with open data regarding the indicators. In Latin America there are still only two initiatives, Bogotá and Buenos Aires. (World Council on City Data, 2016)

4. BELO HORIZONTE AND THE CLIMATE CHANGE

Belo Horizonte is the third biggest Brazilian city, capital of the Minas Gerais state, the core of the southeastern region in Brazil, see Figure 3. With an approximate area of 331 km^2 and a population of 2 502 557 inhabitants, estimated in 2015, it is localized in the core of Minas Gerais state. It is known for its vast green area, with 69 parks with an approximate area of 8,6 million square meters, standing out compared to other Brazilian capitals. (IBGE, 2016a, Prefeitura Municipal de Belo Horizonte, 2016p) The city holds a very high HDI of 0.810, being the 20th in the ranking of municipalities in Brazil. According to Prefeitura Municipal de Belo Horizonte (2014), Belo Horizonte's economy is characterized by the strong services sector, supporting BRL 45.65 billion on the city's total GDP of BRL 81.43 billion in 2013, followed by industry with BRL 15.66 billion and public administration with BRL 8.5 billion. In 2013, the city's GDP per capita was BRL 32 844.41, according to Prefeitura Municipal de Belo Horizonte (2016e).

4.1. Belo Horizonte and international forums for Climate Change

The city is relatively young, being founded on 1897, but it impresses with its insertion and relevance on the international scenario. According to City Government Representative 2 (2016a), the process of internationalization started during the 90s, being institutionalized in 2005 when the Municipal Deputy Secretariat of International Relations was created. Belo Horizonte's internationalization strategy is divided in three dimensions: international projection, international cooperation, and investment attraction and commercial promotion. The secretariat is also responsible for the internationalization process of the environmental agenda, engaging in promoting visibility of the city's public policies and best practices regarding the environmental agenda; in multilateral, triangular, and bilateral cooperation arrangements; and trying to attract investments for projects in the area, participating in cities' networks activities and international events.

The city is in an intense process of internationalization and recognition of its best practices worldwide. This is also true when it comes to sustainable development and climate change issues. The city is deeply involved in a partnership with ICLEI since 1993, when BH became a member of the network. ICLEI is an important network which promotes the sustainability agenda to local governments through projects like POLICS and Urban LEDS.

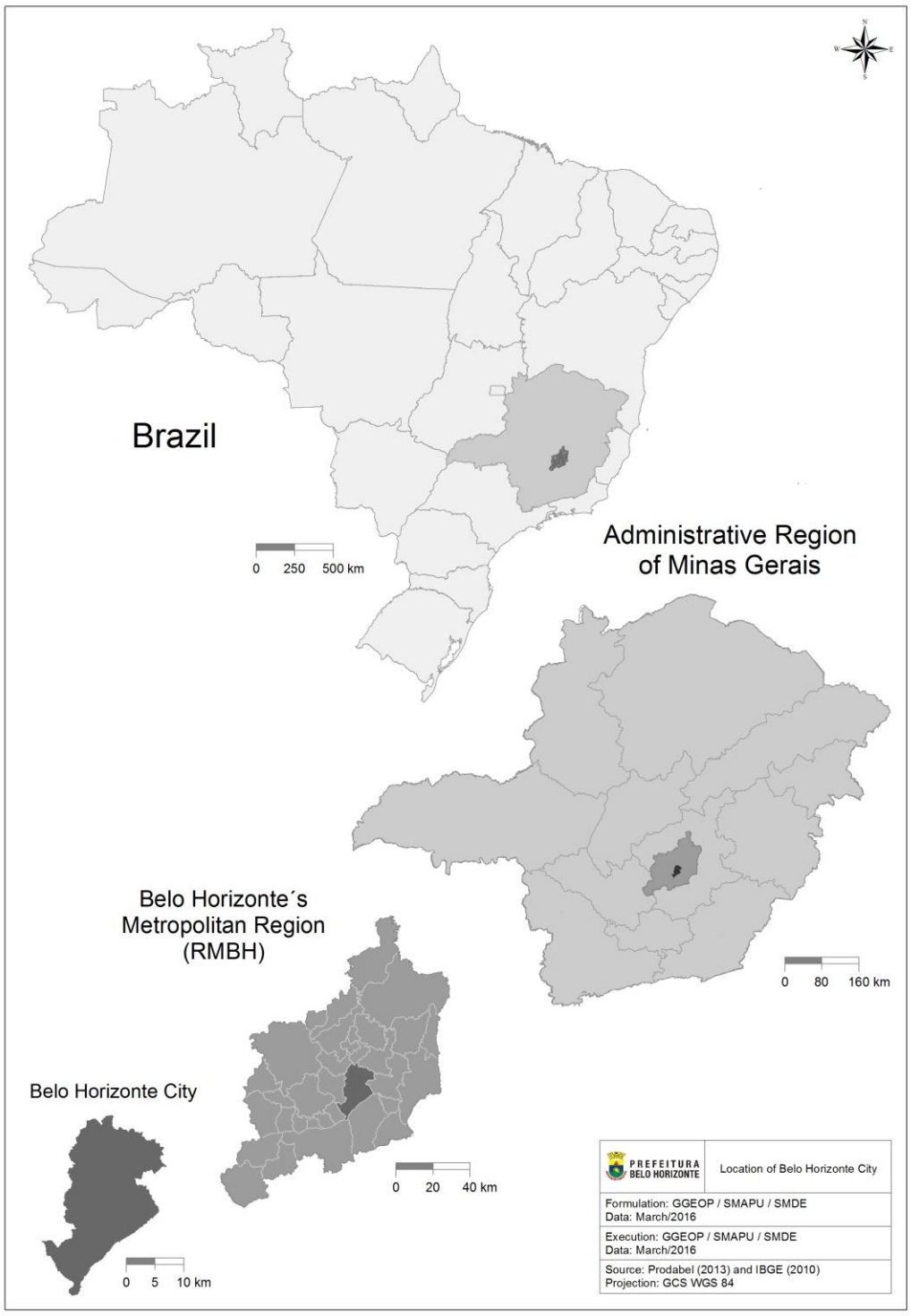

Figure 3 - Location of Belo Horizonte City, Brazil – Projection: GCS WGS 84

Source: Prodabel (2013) and IBGE (2010) through Internal Communication with City Government Representative 2

The city also cooperates with the city of Windhoek, Namibia, in terms of food security; and with WRI, an international research organization on the topics of environment, economy, and human well-being. (City Government Representative 2, 2016a) According to City Government Representative 2 (2016a), *"we realized that working together with other cities and being positioned in the international system can help us by finding new solutions, improving our programs and projects and therefore delivering more efficient and effective policies."*

Apart from that, the city is becoming more visible and present in international events concerning sustainability and climate change this, being confirmed by the presence of the city's delegation at COP19, COP20 and COP21, and the meeting for adoption of the SDGs in New York in 2015. BH's international participation and projection is not exclusively through events. In the last couple of years, the city has participated on WWF's Earth Hour City Challenge, Rockefeller's 100 Resilient Cities Challenge, and Bloomberg's Mayors Challenge. The city was acclaimed with the title of Earth Hour City in 2014 and 2015. Recently, the city has signed two multilateral cooperation agreements that are relevant for mitigation of and adaptation to climate change, the Compact of Mayors, and the Milan Urban Food Policy Pact. (City Government Representative 2, 2016a)

The COP meetings and the signature of Compact of Mayors, provided more international exposure to the city. By signing the Compact, Belo Horizonte affirmed its compromise to publicly report and measure the emissions in the same standards as other cities, and affirmed the commitment to reduce the city's emissions by 20% by 2030. Those initiatives together are a step forward to pursue a sustainable development, and that can be confirmed by the fact that the city is reviewing its long term governmental plan (BH 2030) to adapt to the new SDGs. Also, it is a step forward for the UN and the national governments to acknowledge the subnational governments as important stakeholders for mitigating climate change. (City Government Representative 2, 2016a)

The City Government Representative 2 (2016a) acknowledges that once achieving such recognition, the challenges to overcome are:*" - to conquer financial conditions needed to put our projects and programs into practice; - the integration between federal and local efforts; - capacity building; - and the coordination with other cities throughout cities' networks to optimize resources, construct a greater political influence and strengthen our voice."* One tool to overcome those challenges is the engagement with international networks, *"the international networks are*

platforms to exchange experiences, discover where we need to improve, which policies we have that can become a reference as a best practice, how we can improve and achieve more satisfying results." (City Government Representative 2, 2016a)

4.2. Emissions scenario in Belo Horizonte

Driven by the environmental trends, reassured in the way of its participation in international forums regarding climate change, Belo Horizonte has a history of reporting emissions and implementing actions for mitigation and adaptation to climate change. Currently, the city already published three inventories of GHG emissions. The first inventory being published in 2009, considering the years 2000-2007 as a reference.

The first inventory was elaborated by a private company, MundusCarbo, which won the public bidding system. This company developed the inventory using the methodologies and tools suggested by IPCC Guidelines for National Greenhouse Gas Inventories of 2006, GHG Protocol standards, ISO 14064:2006 and ICLEI orientations. The second inventory, published in 2012, considered updates from the reference years of 2008-2010. However, the methodology used was changed, adopting the methods from the Global Protocol for Community Scale GHG Emissions (GPC 2012), this being a methodology more focused on local GHG inventories concentrating on the urban environment. The third, and last update, was published in 2015 and consisted of the period 2011-2013. The methodology used remained the same as the previous update allowing a more sustained and comparable evolution of the GHG emissions in BH, e.g. allowed to benchmark and compare First GHG Inventory of Belo Horizonte to others. The inventory is based on emissions of CO_2, CH_4 and N_2O, not accounting HFCs, PFCs and SF_6. The emissions of GHG are accounted according to its potential for global warming in a measure unit of ton of equivalent CO_2. (Prefeitura Municipal de Belo Horizonte, 2015)

The relationship between urban expansion, economic development and GHG emissions is given. In Belo Horizonte, from 2000 up to 2013, there was a significant increase in the city GDP, followed by a certain stagnation in population growth, characterizing it as an economic expansion period, mainly supported by the expansion of the tertiary sector (services, commerce etc.). Together with this expansion, was observed an increase in GHG emissions, measured in tons of equivalent CO_2 (tCO_2e). Table 2 summarizes the increase in GDP, population and the emissions. Additionally, is important to acknowledge that the First Inventory in 2009 raised the awareness to measure and

mitigate the city's emissions. If the emissions continue to grow at this rate, by 2030 the city will reach 6 million tCO_2e. This table illustrates the assumptions that economic development, not based on sustainability premises, is deeply attached to increase in emissions. (Prefeitura Municipal de Belo Horizonte, 2013b)

Table 2 - Total Emissions, population and GDP of Belo Horizonte 2000-2013*

Year	Emissions (million tCO_2e)	Population (million)	GDP (BRL Billions)	GDP per capita (BRL 1.00/inhabitants)
2000	2.59	2.24	39.46	17 617.70
2001	2.75	2.26	40.69	18 005.99
2002	2.87	2.29	43.75	19 105.02
2003	2.88	2.31	42.78	18 518.12
2004	2.97	2.34	46.44	19 844.09
2005	3.01	2.36	45.89	19 446.31
2006	3.12	2.39	48.49	20 290.41
2007	3.18	2.38	54.00	22 690.85
2008	3.43	2.38	55.02	23 117.79
2009	3.47	2.38	54.17	22 761.94
2010	3.75	2.38	57.99	24 364.01
2011	3.97	2.40	57.71	24 044.90
2012	4.24	2.43	58.37	24 022.26
2013	4.40	2.46	-	-

Source: SMPL, 2015 in Prefeitura Municipal de Belo Horizonte (2015)

The emissions scenario described in the Inventory was designed according to GPC 2012 designation of scope and sector. Therefore, Prefeitura Municipal de Belo Horizonte (2015) considered emissions under 3 scopes and 3 sectors. The emissions under the scope 1 are emissions generated by activities in BH and occurred within the borders of BH; scope 2 emissions are emissions generated outside the city borders by the energy consumption in BH; and finally, the emissions classified as being of scope 3 are emissions generated by activities inside BH and occurred outside the city borders. Also, the inventories considered emissions in three different sectors. The *stationary units'* sector was related to emissions essentially connected to each stationary unity – or building, which could be residencies, commercial, industries and energy generation. Emissions related to transportation units are under the *mobile units'* sector. Finally, the emissions by the settlement of waste in landfills, the biological treatment of waste and the treatment and/or the discharge of effluents are classified under the *waste* sector. (Prefeitura Municipal de Belo Horizonte, 2013b)

In 2013, the 4.4 tCO_2e were 71% due to energy use in transportation (*mobile units*) sector, 19% due to energy use in *stationary units* and 11% due to *waste*, which can be seen in Figure 4.

The sector related with the biggest share on emissions is *mobile units'* sector, mainly due to the use of fossil fuels, like gasoline, diesel and aviation fuel.

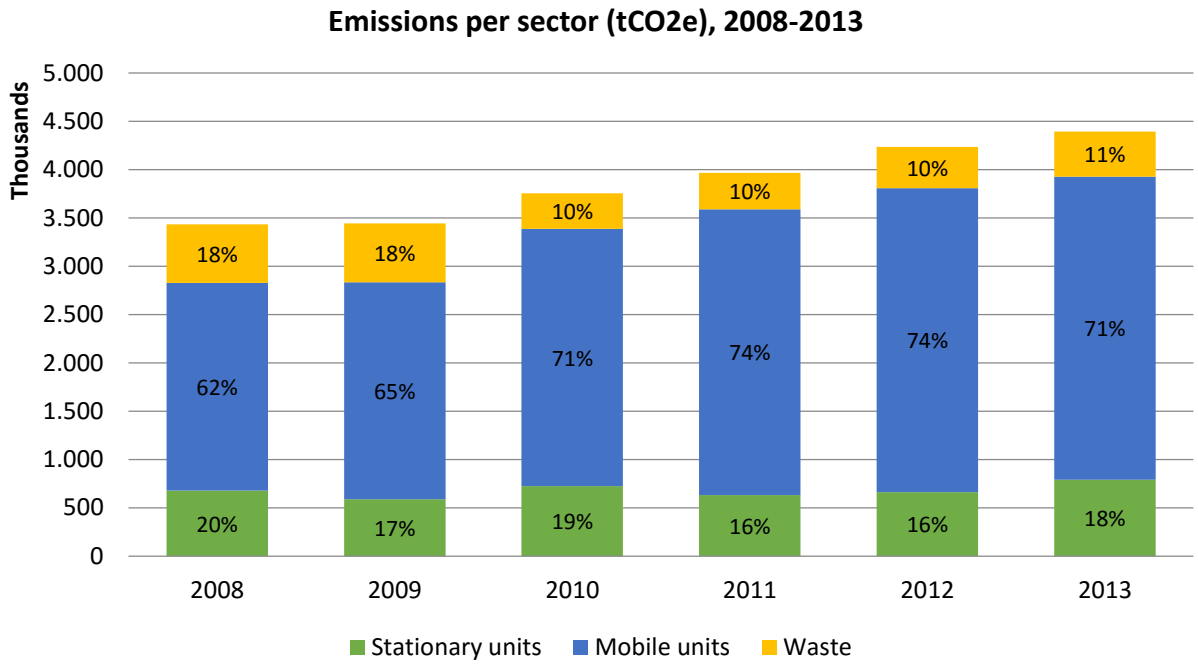

Figure 4 - Consolidated Emissions by Sector
Source: Prefeitura Municipal de Belo Horizonte (2015)

The transportation sector was analyzed dividing into road segment and air segment, not accounting emissions on rail segment attributable to the Brazilian Company of Urban Trains (CBTU) not disclosing the necessary information. Therefore, it can be noted that most of Belo Horizonte's emissions on transportation resulted from the road segment, responsible for 75% of the emissions in the sector, as shown in Figure 5. The biggest share of this sector emissions is due to the use of gasoline – see Figure 6 – and the increasing fleet of light vehicles. The slight grow through the timeframe in the air segment's emissions is also related to the growth in GDP per capita and the economic development of the period.

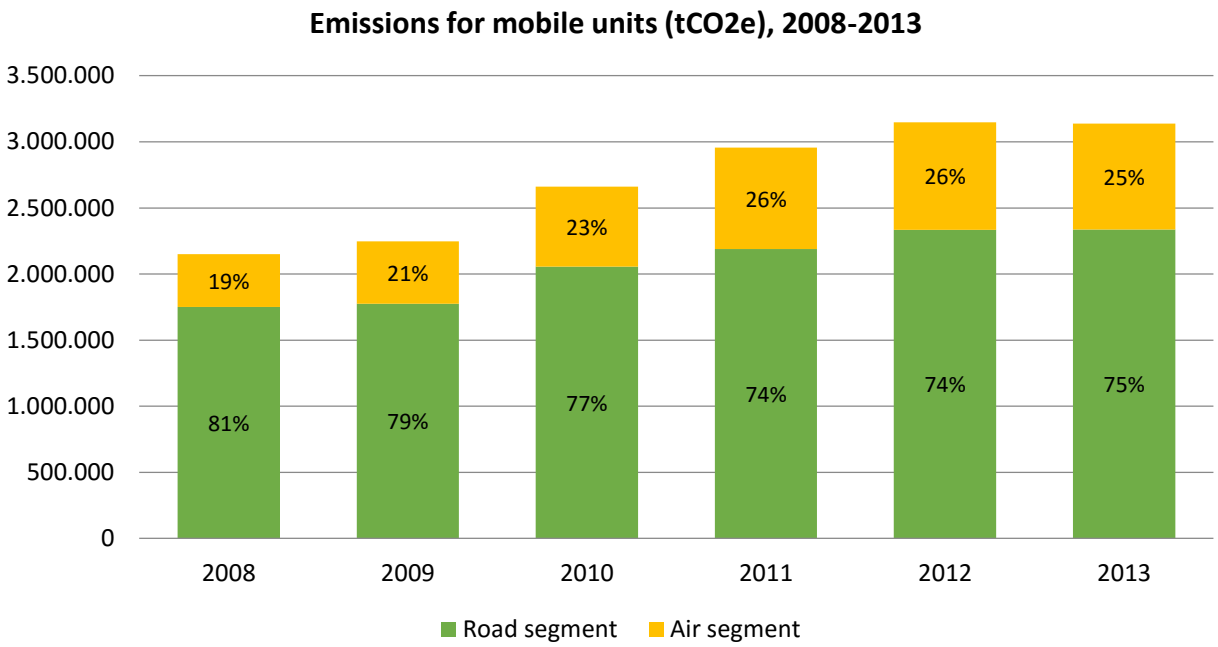

Figure 5 - Emissions for Mobile Units - detailed by segment
Source: Prefeitura Municipal de Belo Horizonte (2015)

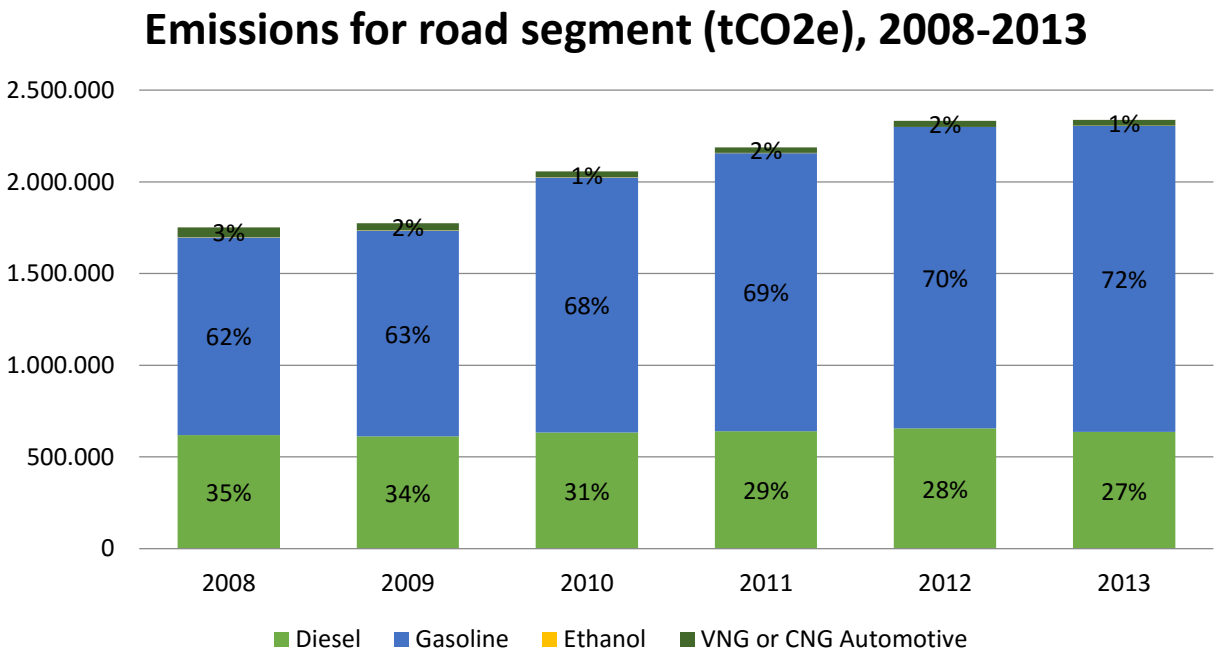

Figure 6 - Emissions for road segment (tCO2e), 2008-2013
Source: Prefeitura Municipal de Belo Horizonte (2015)

The *stationary unit's* sector is divided between residential buildings, commercial/institutional buildings and industrial use. In Figure 7, it is visible that the energy

consume in residential and commercial/institutional buildings is slightly more prominent than in industry use, despite noting a certain balance between the segments. The energy consume was measured according to the use of liquefied petroleum gas (LPG) and power, which are considered inelastic goods because of being first necessity goods. Therefore, their demand is not significantly impacted by the economic contraction. The biggest share of residential segment emissions is due to LPG use, with 50% of the residential segment in 2013, given its carbon intensity and the low carbon intensity of the Brazilian power matrix.

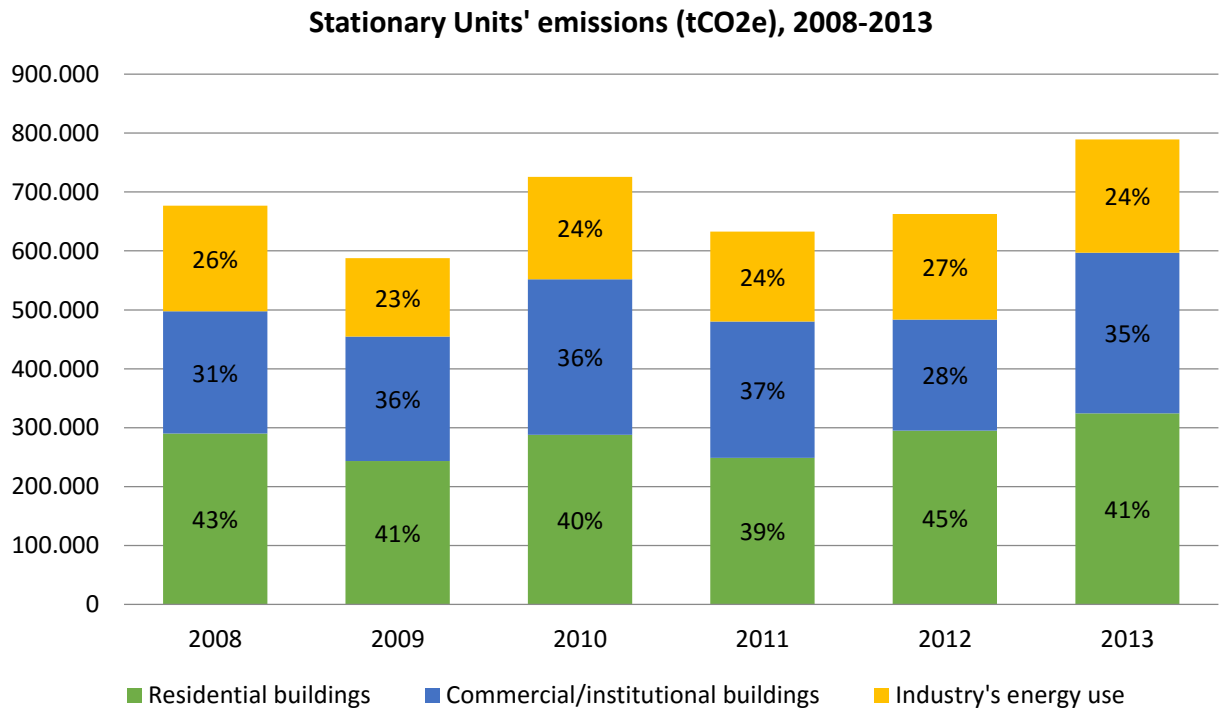

Figure 7 - Stationary Units' emissions (tCO2e), 2008-2013
Source: Prefeitura Municipal de Belo Horizonte (2015)

The waste sector is characterized by having the biggest share of emissions from solid waste in landfills in the city, followed by sewage and waste composting, as showed in Figure 8. The decrease in 2010 is due to the installation of the thermoelectric plant driven by biogas in the Macaúbas landfill. The increase after that is due to the increase in the volume of waste received by the Macaúbas landfill. The high emissions from the use of landfill is because there are low levels of recycling of urban waste. There was also an increase in the average amount of waste produced by the average individual. Following this trend, the sewage segment has relevant increases whilst the basic sanitation systems are enlarged.

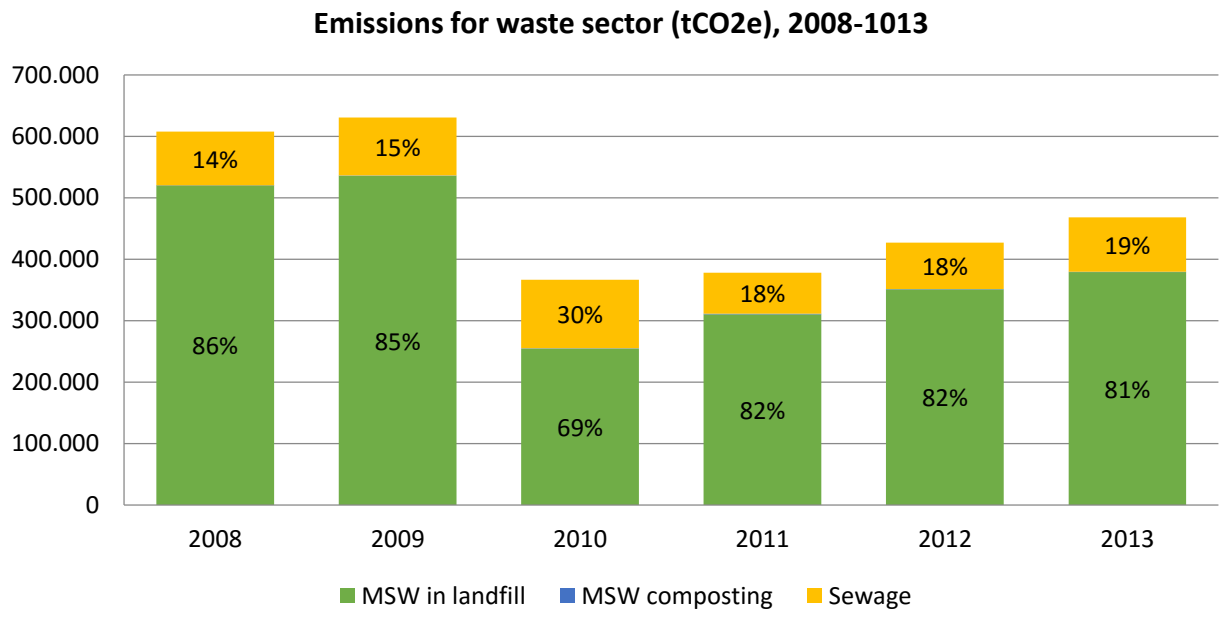

Figure 8 - Emissions for waste sector (tCO2e), 2008-2013
Source: Prefeitura Municipal de Belo Horizonte (2015)

4.3. Low-carbon related projects in Belo Horizonte

Belo Horizonte is in an ongoing process of formulation and implementation of low-carbon actions and policies, and has a remarkable experience with this amongst the local governments around the world. The most current projects are the Climate Change Vulnerability Study of Belo Horizonte, CLIMAS, PREGEE, TRACE, Urban LEDS, and the Environmental Sustainability Certification Program.

4.3.1. Climate Change Vulnerability Study of Belo Horizonte

The vulnerability study is a multi-stakeholder project to be formulated with collaboration of the City Government, the Support Foundation of Research in Minas Gerais (FAPEMIG), the National Council of Technological and Scientific Development (CNPQ) and the private company WayCarbon. This project aims to evaluate the potential effects of climate change in Belo Horizonte and identify the related socioeconomic, physical, infrastructural and administrative vulnerabilities. This project will support the defining of priority actions and the cost-benefit analysis of adaptation measures in order to reduce the impact of climate change in the city and promote sustainable development. The project aims to build basis for the development of a Municipal Plan for Adaptation to Climate Change. (Prefeitura Municipal de Belo Horizonte, 2016i)

4.3.2. CLIMAS

It is estimated to resort on a web software, CLIMAS (Climate Management System), to manage the emissions. This software consists of a platform in which, with data fed by the main governmental agencies on transport, energy and sanitation, can automatically calculate the emissions and caption of GHG. It also aims to generate and update yearly reports on GHG emissions according to GPC, CDP Cities and Global Reporting Initiative (GRI), easily being able to follow up the evolution of the targeted levels of emissions. The software was planned to be implemented by the end of 2015. (Prefeitura Municipal de Belo Horizonte, 2016i) However, according to City Government Representative 1 (2016a), the implementation of this software is scheduled for the second semester of 2016.

4.3.3. TRACE

TRACE (Tool for Rapid Assessment of City Energy) is a rapid assessment tool, created by the World Bank, composed by three modules: energy benchmarking, sector prioritization and intervention selection. The tool is used to first pinpoint the energy uses according to 28 key indicators. Then, in the sector prioritization module, the city can measure the sectors' potential for improvement, the energy spent in each sector, and the city authority control of the sectors. There are six sectors: transportation, street lighting, building, electricity and warming, solid waste and treated and residual waters. This module provides a background to decide the priority of each sector, helping to identify the sectors with low energy efficiency performance and promote the efficient use of energy in the city. The third, and last module, helps the city to choose their intervention actions through a set of recommendations according to TRACE's database. (World Bank, , 2013)

In Belo Horizonte, the first city in Latin America to implement this tool, it enabled a better dialogue between those sectors and the comparison with 60 other cities worldwide according to the key performance indicators. This type of dialogue in between the domestic actors and other international experiences is fruitful to promote the exchange of best practices. The use of this tool resulted in the identification of priority sectors with the potential to save both energy and financial resources, in order to achieve energy efficiency. The PREGEE energy axis' actions were based on the results from the use of this tool. (Prefeitura Municipal de Belo Horizonte, 2016i)

4.3.4. Urban LEDS

Urban LEDS - Urban Low Emissions Development Strategy – is a project developed by ICLEI with the help of UN-Habitat, funded by the European Commission, in order to get the 37 cities to develop low-carbon development strategies in Brazil, India, Indonesia and South Africa. The goal of the project is to define *"a pathway to transition a city to a low emission green and inclusive urban economy, through its integration into city development plans and processes."* (ICLEI, 2016a) The expected outcomes from the adoption of this project by the cities were: adoption of a low-carbon development model; definition of an action plan on low-carbon development; preparation of GHG inventories; and implementation of mitigation projects.

The project was launched in 2012 and had the duration of 42 months. The project was structured to happen in different cities that were divided into model and satellite cities. The model cities were those which had no previous experience with planning and executing low-carbon strategies. The satellite cities already had structured low-carbon actions and/or policies. Belo Horizonte was chosen as a satellite city, already having some structured low-carbon related actions and policies. Despite not being built according to the Urban LEDS methodology, the PREGEE was accepted as a framework for the city to meet the goal of the project. During the Urban LEDS evaluation meeting in 2015, the city was set as one of the most successful experiences amongst the participants due to its PREGEE and the CMMCE actions. (Prefeitura Municipal de Belo Horizonte, 2016i)

4.3.5. Environmental Sustainability Certification Program

The certification program conceived by the municipal government is an initiative launched to be part of the action plan for the FIFA World Cup in 2014. As a requirement from FIFA, the event should be designed in order to reduce the social-environmental impacts resulting from the event. It is an environmental certification to reduce the impact in four main dimensions: water, power, waste and emissions. The certification is intended to reach both public and private companies, residences and industries. It is divided into three categories, Bronze, Silver and Gold according to the number of dimension reached with the practices: Gold is when the practices involve three or more dimensions; Silver two dimensions; Bronze one dimension. The certification program is voluntary and it is intended to help to achieve the targets to reduce the emissions up to 2030 and aim to promote sustainable development. (Prefeitura Municipal de Belo Horizonte, 2016a)

4.3.6. PREGEE

The Municipal Plan on Reducing GHG Emissions (PREGEE) is an initiative from the executive power to set up measures to enable to reduce the emissions without harming the economic development of the city. The CMMCE was designated to develop and follow up this plan implementation. The plan was established so that the commitments and targets to reduce GHG in Belo Horizonte were met. It is a set of measures and short, medium and long-term guidelines for the city's low-carbon economic development organized into four main axes: Transportation, Energy, Sanitation and Waste, and Adaptation. (Prefeitura Municipal de Belo Horizonte, 2013b)

The plan was based on the Municipal Policy for Mitigation of Climate Change Effects, published in 2011, and on the experiences of other cities around the world. The experiences and insights from non-governmental actors were also taking into account in the planning process of the plan through their participation in open workshops and in the CMMCE Working Groups (WG). The WGs represent the four main axes in mobility, sanitation and waste, energy and sustainable buildings, and adaptation. Their main purpose to follow the measures and actions provided by the plan and guarantee its implementation. (Prefeitura Municipal de Belo Horizonte, 2016i)

According to Carvalho (2016), City Government Representative 1 (2016a), after the formulation process, the Plan was approved by the members of the CMMCE on May of 2014, and institutionalized through a municipal decree in September of 2014, guaranteeing, in this way, the continuation of the plan even if the executive power changes over time. According to City Government Representative 1 (2016a), this decree is established in a general way, not stating the PREGEE actions and measures. That was a deliberate choice in order to maintain the adaptability of the plan face the changes in the city's reality and context. After this period of institutionalization, the PREGEE suffered some changes regarding the measures and actions, according to what it was proposed and the capacity of each secretariat and superintendence to put it into practice. Those changes were supervised and followed by the respective WG, which defined the implementation strategies for the possible actions and measures, and set the monitoring processes for the current actions and measures. Currently, the monitoring phase for the Energy, Mobility and Sustainable Building, and Adaptation WGs are finished, while the WG on Sanitation and Waste is still working on their review.

The flexible nature of the Plan is intended to fit its implementation to the changing of the city scenario and the government technical, political and economic competences. The changing, inclusion, and extinguishing processes of new actions must be approved in a CMMCE plenary. The WG, through the CMMCE, can recommend the executive power to include the new proposed actions in its Budget Plan. The revision processes are intended to systematically follow the proposed actions and the operative actions, comparing with the updated data on emissions, in order to ensure that the reduction goals are being reached. In this sense, the executive power could act and reorganize the budget accordingly if the actions' goals and targets are being effectively achieved. (Prefeitura Municipal de Belo Horizonte, 2016i).

5. CLIMATE CHANGE GOVERNANCE IN BELO HORIZONTE

The governance of climate change is already a difficult task when it comes to countries because it requires a multidisciplinary action in order to achieve the goals of reducing the GHG emissions. As argued previously, when it comes to subnational governments – the cities – the level where the policy is implemented, the matter can face different and bigger challenges. The government is a part of the Brazilian Federation, having political administrative and financial autonomy, and its administration is divided into executive and legislative, embodied in the city hall and the city council, respectively. There is no hierarchy in between the powers on the municipal level, only a division of the roles and responsibilities, which should cooperate to achieve the common public interest. The executive power is divided into agencies (secretariats and departments) and entities (autarchies, foundations and state companies). The current model of executive power in Belo Horizonte is inclined to a more systemic approach to governmental action, based on programs and projects, which can cut across the spheres and levels of government. The projects and programs are usually focused on meeting the public needs, integrating structured policies, that can have financing and resources shared by the different levels of government (the Union, states and municipalities). Also, the programs and projects have a strong base of performance indicators in order to measure its efficiency levels, therefore to decide on its continuation and scope. (Klering et al., 2011)

The current mayor is in his second mandate, and as an elected official he elaborated a Multiannual Plan for Government Action (PPAG) for the four-year period of the mandate. This states the long-term strategic goals in 12 areas in order to reach the desired socioeconomic, environmental and institutional transformations. The plan is designed to present the programs consistent with the Government Plan and the Long-Term Strategic Plan for Belo Horizonte 2030. In each program there are defined goals, expected results and indicators, as milestones and deadlines, the responsible agency, and the financial resources for it. The programs can be evaluated according to their effectiveness along the time. Along the PPAG, the 12 areas are: healthy city, education, mobility city, safe city, prosperity, modernity, city with all ‘Vilas Vivas’ (it is a program to promote infrastructure to villas, settlements and slums), shared city, sustainable city, city of all, culture, and metropolitan integration. In each of these areas, there are the normal programs and projects as well as the sustainer programs. The sustainer programs are designed to make the desired changes to the city and achieve the development process in the long-run. The mayor, the chair of

the responsible agency, the project manager and secretariats and public managers sign a commitment to results for each sustainer project. (Prefeitura Municipal de Belo Horizonte, 2014)

Normally, the PPAG follows what is stated in the Government Program, established before the elections, which also holds for the current governmental administration in the city. Analyzing and comparing the proposals in both documents, we found out that the Government Program (2014-2017) of Márcio Lacerda – the current mayor – is well translated into programs and projects in the correspondent PPAG. It is important to state that the programs and the budget defined in the PPAG passes through an approval and several evaluation processes in which the budget can be redefined and adjusted (usually for less) by the City Council.

The structure of the municipal budget is complex and has three main tools to help its formulation. First, the budget is estimated in the PPAG for specific programs and services that are lasting for more than a year, establishing the governmental goals and priorities for the mandate period. Then, the budget passes through a process of revision and its guidelines are defined by the Municipal Directives for Budget (LDO), which regulates the budget planning, establishing the priorities and targets within PPAG to the next year. The Annual Budget Law (LOA) is what defines the municipal budget for the year, and is composed by programs, projects and actions that meet the goals and priorities in the LDO and the guidelines for executing it. LOA defines income sources and authorizes the public expenses according to governmental agency. (Prefeitura Municipal de Belo Horizonte, 2016c)

In terms of the PREGEE, the plan was designed, published and then revised in 2014. After this revision, the plan was voted on and approved in a plenary session at the CMMCE in May of 2014, being institutionalized by the decree in September of the same year. Now the PREGEE is at the monitoring phase, in which each working group are checking the actions proposed by the plan and verifying if they have a correspondent program/action that is being executed by the city government, through the city's action plan, PPAG. For those actions that are already described in the PPAG, the working group make a choice of which text to adopt, the one in the PPAG or the one in the PREGEE. The actions are also compared with the ones which resulted from the city's Municipal Conference on Urban Policy in 2014, which define guidelines for the city and has a mandatory characteristic. After that, the working group bring up indicators to monitor the implementation of those actions. After this process, the actions need to be approved under the city's

Director Plan by the City Council. The Director Plan is a municipal law drafted with the participation of the Municipality, citizens and the City Council. It also defines the strategic goals for urban development, the urban policy guidelines, the urban management model and its instruments, and the macro-zoning of the city. Its goals are to organize the territorial planning, the operation and development of the municipality as well as the prioritization of public investment. (Câmara Municipal de Belo Horizonte, 2016c)

Therefore, the actions listed in the PREGEE needs to be able to be governed. They will be put into practice if they have any correspondent action at the PPAG, the Municipal Conference on Urban Policy or suggested to be included on the Director Plan. (City Government Representative 1, 2016a, City Government Representative 1, 2016b) The Director Plan only includes measures and actions regarding transportation and energy axes, for example the PlanMob, which need to be approved under the Director Plan. The actions approved under the Director Plan will be monitored by the CMMCE. If the actions are not listed in the PPAG or mentioned at the Municipal Conference on Urban Policy, but are listed at the PREGEE, they are subject of feasibility analysis (technical, political and economic), and, if feasible, will be suggested to be included in the government action plan. This analysis process has not happened yet. It is important to state that all these institutional processes have to happen in accordance to the Municipal Organic Law – the correspondent of the Constitution at the municipal level.

This institutional arrangement realized in the form of PPAG and the Director Plan is, allegedly, a good managerial tool for multidisciplinary and long-term policies. That is the case of the PREGEE and the climate change policy, since they are multidisciplinary and require a multilevel governance. The PREGEE does not have a chapter exclusively dedicated to it in the PPAG, but there are projects and actions in most of its 12 areas. The actions suggested at the Municipal Conference on Urban Policies were not analyzed here, as well as the Director Plan due to the time constraint and the limitation of sources. Also, because of those limitations, on the PPAG realm only the projects under the area *Mobility City* and *Sustainable City* are analyzed in this study and compared to the actions proposed by the PREGEE – see ANNEX I.

Together with the PPAG, the city has mechanisms for shared management, including the civil society in the decision making process. The municipal Decree 14.639/11 creates general norms for the operation of the municipal public policies counsels, entities created by the

municipality that can hold advisory or deliberative power to monitor implementation of policies and public services, in order to ensure the citizen participation in the democratic management of policies and public services. (Prefeitura Municipal de Belo Horizonte, 2011) That means, for this study, the government ensures the civil society participation in the entities of the committee to monitor the PREGEE implementation. In the case of PREGEE, it is vital to hear and empower the civil society regarding mitigation and adaptation of climate change, since the individuals are the units affected by it.

The PREGEE analyzed axes are under the umbrella of four main governmental agencies, SMMA – the environmental secretariat -, SUDECAP – the city's development superintendence -, BHTRANS – the transportation and traffic company of Belo Horizonte - and SLU – superintendence of urban cleaning – that manage most of the actions in the plan. Also, the PREGEE is monitored by members of CMMCE, a multi-stakeholder committee. Its members and how they relate to the climate change issue are explained in the subsection *Climate Change and the Stakeholders in Belo Horizonte*.

5.1. Legal framework for climate change

As explained in Chapter 1, the legal framework in Brazil is divided by units. As a bigger unit, there is the federal legislation, being followed by the state legislation and the municipal legislation. It is important to explain the legal hierarchy in Brazil, which is composed by the Constitution, complementary laws, ordinary laws, decrees, ordinance, resolution and instruction. The Constitution is the basis of all jurisprudence, being above all other laws. Laws are above decrees. Decrees are above ordinances, resolutions and instructions. None of these can contradict anything higher in the legal hierarchy. It is important to state that the state Constitutions and the Organic Laws of the municipalities have the same place in the regional/local hierarchy as the Federal Constitution. This study has analyzed laws and decrees, and there is a need to differentiate them. Besides the laws being above the decrees, the laws are constituted and approved by the legislative power and approved and signed by the executive power, having the power to enforce action or inaction on a subject. The decree has less normative strength, because it is simply elaborated and signed by the mayor or their representative in their absence, not being discussed and approved by the legislative power. The decree has the goal of regulating the law, by creating ways to execute the law. (Souza, 2014)

In a very simplified explanation, the legislative process in the municipal sphere is started by the proposition of a bill to the City Council. A bill can be proposed by the city counselor, the mayor, by a commission or by 5% of the voters in the municipality. Before being voted, the bill passes through an analysis by a permanent or temporary City Council commission. The commission technically analyses in order to support the City Council decisions on the matter, emitting a report that is presented to the counselors to vote in the first round. If the bill is rejected in the first round voting, it is archived. If approved, the counselors, the mayor or 5% of the voters can make amends to it, in which will be voted on during the second round. If rejected in the second round, the bill is archived, if approved it goes to the commission on Legislation and Justice to elaborate the final wording. After that, the bill becomes a proposition of law that is directed to the mayor, which can agree or veto the proposition of law. If vetoed, the proposition of law returns to the City Council to decide on the matter. In this moment, a special commission is established to analyze the veto and it is deliberated in plenary at the City Council. If rejected, it is archived, if approved, the proposition becomes a law and it is publicized. (Câmara Municipal de Belo Horizonte, 2016b)

Establishing a legal framework for climate change is a relatively new concept in terms of subnational governments. In Brazil, very few cities already have a specific law for climate change, institutionalizing the tools for mitigation and adaptation, but Belo Horizonte is one of them. The problem regarding this type of law is that, usually, they are more advisory than enforcing. This does not necessarily mean it is a weak framework, since supported by laws and decrees specifically targeting the key areas, such as waste and sanitation, transportation and energy, for example, a general climate change law can consolidate a strong legal framework.

In Belo Horizonte, the law 10.175/2011 introduced the Municipal Policy for Mitigation of Climate Change Effects, establishing the target for reduction of 30% of GHG emissions, according to a scenario to be defined in a study by the city hall, to be achieved in 4 years after the publication. The law institutes strategies of mitigation and adaptation, fiscal and economic instruments under 6 areas: transportation, energy, waste management, health, construction, use of the soil. However, it is important to state that these strategies and instruments are not quantified in this law, depending on supportive laws or decrees to institutionalize the quantification of these. Also, the only quantified target is the reduction target which did not have a strong basis when formulated, as the city did not have a concrete study on emissions to base it on at the time. It is important to notice

that the Decree 14.794/2012, established a different reduction target of 20% until 2030 having the 2007 emissions as a baseline scenario.

Other laws account for actions that could affect GHG emissions through the use and incentive of alternative energy sources, like Law 9.340/2007 and Law 9.415/2007. The first establishes the biodiesel program in Belo Horizonte, in order to incentivize the use of renewables, as well as researches on renewables. This law also establishes the possibility of using biodiesel in official vehicles from the municipal administration. Supporting this program, Law 9.415/2007 institutes the Municipal Policy on Incentive Use of Alternative Forms of Energy requiring further action on financing research on associated technologies, creation of incentives for buildings that use solar energy and GLP for heating water, pursuing technical and financial cooperation with state and federal agencies and entities. In theory, this policy should create tax incentives for the buildings which use those kind of energy, yet, those initiatives are still tentative. Up to this date, there were no bills regarding the tax incentives for the use of solar energy that were passed in the City Council. The coordination of this policy is also under the scope of CMMCE. The Decree 13.743/2009 established the Program of Energy Conservation in the Municipal Public Administration, requiring technical and financial support for energy conservation, as well as to organize the communication within the public administration and the civil society in order to promote energy conservation in public spaces.

Some laws provide a tentative framework for reducing waste, whereas Law 9.529/2008 states about the exclusive use of ecological plastic bags and Law 9.545/2008 states the use of old tires' rubber in the composition of asphalt used by the municipality. Regarding transportation, Decrees 13.744/2009 and 15.317/2013 are the regulatory mark. The first decree states that SMMA inspects the envisaged regulation about the emissions and sound pollution from otto cycle or diesel engines. The second, establishes the Urban Mobility Director Plan for Belo Horizonte and the guidelines for following up and monitoring its implementation, evaluation and revision.

Decrees 12.362/2006, 13.016/2007, 13.539/2009, 13.540/2009, 14.474/2011 and Resolution 01/2007 designate regarding the composition of CMMCE, its coordinators and its secretarial function and positions. Concerning PREGEE itself, Decrees 14.794/2012 and 15.690/2014 provides a legal basis for the PREGEE to work as a tool of the Municipal Policy for Mitigation of Climate Change Effects.

Table 3 is the organization of the legal framework regarding the committee focus areas, therefore, the PREGEE legal basis. The table is organized according to the law/decree, its scope and the related PREGEE axis. It is important to state that the PREGEE was established in 2013 and some of the laws are predate of the plan.

Table 3 - Legal Framework for low-carbon related actions and related PREGEE axis

Law/Decree	Scope	PREGEE Axis
Law 9.340/2007	Establishes the Biodiesel program in Belo Horizonte	Transportation
Law 9.415/2007	Establishes the Municipal policy for incentive to use alternative forms of energy	Energy
Law 9.529/2008	Establishes the substitution of regular plastic bags by ecological plastic bags	Sanitation and Waste
Law 9.545/2008	Define that rubber from old tires should be in the composition of asphalt used by the city.	Sanitation and Waste
Law 9.546/2008	Create the Environmental Kindness Certificate	All
Law 10.175/2011	Institutes the Municipal Policy for Mitigation of Climate Change effects	All
Decree 12.362/2006	Creation of CMMCE	All
Decree 13.016/2007	Establishes the CMMCE as the coordinator of actions related to the Municipal Policy for the Use of Alternative Energy (Law 9.415/2007)	All
Decree 13.539/2009	Creation of Management Information and Technical Advice on SMMA	All
Decree 13.540/2009	Establishes that the Secretariat of SMMA will be the coordinator of CMMCE	All
Decree 13.743/2009	Establishes the Program for conservation of energy in the public administration and create the Unity of Strategic Management (UGEM)	Energy
Decree 13.744/2009	Regulates about the emissions and sound pollution from otto cycle or diesel engines to be inspected by the SMMA	Transportation
Decree 14.474/2011	Establishes the organizations/groups who will hold members at CMMCE	All
Decree 14.794/2012	Promotes the Municipal Policy for Mitigation of Climate Change effects through the Municipal Plan for Reducing the GHG Emissions (PREGEE)	All
Decree 15.317/2013	Establishes the Urban Mobility Director Plan for Belo Horizonte and the guidelines for follow-up and monitoring of its implementation, evaluation and revision	Transportation
Decree 15.690/2014	Institutionalizes the PREGEE and establishes that SMMA is responsible for supervise and follow-up the Plan with help of CMMCE	All
Resolution 01/2007	Institutes the bylaws of CMMCE	All

Source: Based on Prefeitura Municipal de Belo Horizonte (2016h), Prefeitura Municipal de Belo Horizonte (2013b).

Having a framework with several institutional tools to combat climate change is not usual among Brazilian cities. However, the framework, compared to model sustainable cities around the world, is still weak in terms of quantification and measurement in the diverse subject areas of PREGEE. It is not easy to compare cities with different institutional arrangements and governance tools, but the quantification and measurement is an important step in order to achieve sustainable

reductions of emissions. Otherwise, laws and decrees will be merely advisory, lacking more targeted areas to work, being in default of individual interpretation.

The regulatory mark of PREGEE is guaranteed by few laws and decrees, as presented. Additionally, the plan has some tools for lasting within the Director Plan and the Municipal Organic Law. Nevertheless, its actions are not institutionalized in an individual way. Some of the actions are assured by the PPAG, but are subject to change across different mandates of the executive power. The next chapter explores the analysis of crossing the PREGEE actions with the PPAG proposals and indicators, that are summed up in ANNEX I.

5.2. Climate Change and the Stakeholders in Belo Horizonte

As mentioned in Chapter 2, interviews with key stakeholders were imperative to the analysis. The sampling process considered the need to organize the sources and interviewees in order to cover the whole range of actors involved in planning and implementing the PREGEE. In this sense, the stakeholders were chosen in the selection of actors who are active in the CMMCE. The committee aims to elaborate actions for mitigation of GHG, focusing on the key areas: renewable energy; biogas from decomposition; energy efficiency and smart use; reduce, reuse and recycle of waste; increase the green area; public access of information and dissemination of this information regarding climate change; incentive to new studies and researches from universities, NGOs and community associations; etc. Under the eco-efficiency area, the committee is compelled to do studies to implement indicators of environmental quality and establish targets and procedures regarding eco-efficiency. Moreover, it should encourage the Brazilian Program of Habitat Quality and Productivity (PBQP-H) from the Cities Ministry. (Prefeitura Municipal de Belo Horizonte, 2016h)

This committee was established in order to articulate the public and private initiatives on mitigation of GHG emissions. It is a multi-stakeholder platform composed by members of the City Government, the City Council, the Minas Gerais State government, universities, NGOs, and Industry and Trade associations. The committee is divided into WGs composed by members of CMMCE and others. Since 2014, there are two monthly meetings of the committee, one is open to all members with the executive secretary of the committee, in which new topics and documents are presented to all members. The second is the plenary, in which the documents of the policy, projects, tools and technologies are presented. Also during the plenary, the PREGEE's proposals and

suggestions are voted on, in order to be consolidated. (Carvalho, 2016) Those who are the most relevant members for this study are presented below. The list of the members and their articulation regarding the PREGEE within the committee can be found in ANNEX II.

5.2.1. Municipal Governmental agencies

SMMA

Created in Belo Horizonte in the year 1983, the Municipal Secretariat of Environment (SMMA) is responsible for the management of the environmental policies in the city, and is therefore responsible for implementing some of PREGEE's actions. The secretariat, in cooperation with other public agencies, is responsible for inserting environmental issues within the city's planning process, functioning as a structural agent in the execution process of public policies. The role of this agency also goes through licensing processes, inspection, administration of parks and guaranteeing investments in and the application of the environmental legislation throughout all the municipal government structure. Under the SMMA umbrella is the CMMCE and COMAM, the Municipal Council on Environment, which is a collegiate body with normative and deliberative function, composed by representatives of different sectors. (Prefeitura Municipal de Belo Horizonte, 2016g)

BHTRANS

The company responsible for the implementation of the Transportation axis' actions is a municipal public transport company, which 98% is owned by the City Hall and has a mission to *"safeguard urban mobility oriented to people's quality of life and sustainable development of Belo Horizonte, contributing to the metropolitan integration."* (BHTRANS, 2016). Its strategic plan up to 2020 aims to promote and enlarge the access to services, work opportunities and leisure through promoting a quality public transportation system with reduced costs and travel time, ensuring traffic safety and contributing to environmental quality. The company developed the city's mobility plan (PlanMob-BH) which was instituted by Decree 15.317/2013 (Prefeitura Municipal de Belo Horizonte, 2013a), establishing guidelines to monitor and follow up its implementation, evaluation and period revision. Through PlanMob, the company aims to orient the City Hall actions on public, individual and non-motorized transportation in order to fulfill the current and future needs regarding people's mobility in Belo Horizonte. PlanMob embodies the PREGEE actions for transportation, in order to reduce the GHG emissions. (BHTRANS, 2016)

SLU

SLU is the Superintendence of Urban Cleaning, *"local authority responsible for formulating, controlling and executing programs and urban cleaning related activities in Belo Horizonte."* Among the services provided by SLU are the collection of waste and recyclables, waste grounding, sweeping and weeding in the public spaces. All the services are provided thinking of enlarging the environmental, social and economic benefits according to the principles of sustainable development, in order to reduce the negative environmental effects of waste in the city. Its mission is to *"ensure a clean, beautiful and environmentally sustainable city, providing cleaning and waste treatment services with quality, valuing the agents involved and the participation of society."*. The company is responsible for implementing the governmental policy for the urban cleaning system and the targets regarding waste management in the Director Plan, all in collaboration of the direct administration of executive power. (Prefeitura Municipal de Belo Horizonte, 2016m)

SUDECAP

Superintendence of the Capital Development is the agency responsible for executing actions on public urban infrastructure in Belo Horizonte. Within CMMCE, SUDECAP is responsible for executing actions on PREGEE's Energy axis, supported by CEMIG and SMMA. Together with World Bank and its TRACE tool, SUDECAP discussed and implemented actions regarding the substitution to LED lights in all public illumination, including the traffic lights. (Prefeitura Municipal de Belo Horizonte, 2016n, City Government Representative 1, 2016b)

City Council

The representative of the City Council at CMMCE are Sérgio Fernando Pinho Tavares as a sitting member from PV (Green Party), which is one of the few councilors that are following the municipal discussions of climate change.

Within the City Council, the permanent commissions hold meetings regarding key areas of public interest. Three of these commissions are explained in this study as being related to PREGEE analyzed axes: Permanent Commission on Environmental and Urban Policy; Permanent Commission on Economic Development, Transport and Road System; Permanent Commission on Health and Sanitation. The Permanent Commissions are integrated bodies to City Council, with pertinent proportional party composition, and has continuous operation in all legislatures, that

analyze a matter from a technical standpoint, helping the decisions concerning bills. The commissions act through public hearings, invitation and/or request of information from authorities or civil society.

The Commission on Environmental and Urban Policy is responsible for analyzing bills, requirements and other propositions on matters related to environmental law, local urban law and municipal buildings. The Commission on Economic Development, Transport and Road System is responsible for analyzing the matters on development plans, public construction, planning and management of public transport, traffic engineering and safety, metropolitan transport and traffic matters, and housing policy. The Commission on Health and Sanitation analyzes matters on public health, drugs, urban cleaning, waste management, sewages and sewage treatment. (Câmara Municipal de Belo Horizonte, 2016a) Despite those permanent commissions analyzing matters and actions that somehow concern climate change, there is no commission to analyze propositions on climate change separately.

Others

Other secretariats participate on CMMCE meetings and working groups as well, but in minor scale or importance of action, according to data analyzed on Prefeitura Municipal de Belo Horizonte websites. SMSU (Municipal Secretariat on Urban Services) is responsible for the implementation of public policies regarding the city's organization in order to promote a better urban planning focusing on cleanliness, mobility, safety and quality of life in the city. Therefore, the secretariat is directly connected with SLU and BHTRANS, allowing the development of integrated strategies related to urban development and planning.(2016l) URBEL is the public Company on Urbanization and Housing in Belo Horizonte, responsible for implementing housing policies in the city. The company is responsible for the housing project Vila Viva, with the goal of integrating villages and slums into the urban structure. (2016o) SMAGC (Municipal Deputy Secretariat of Shared Management) has the goal to involve the citizens in the policy making process through participatory mechanisms to decide about the budget, the urban planning and the Neighborhood Associations participation. (2016f) SMSA (Municipal Secretariat of Health) is responsible for implementing public health policies, it manages bodies of basic, specialized and urgency treatment in Belo Horizonte. (2016k) SMED is the Municipal Secretariat of Education, that aims to include and promote opportunities to all citizens, focusing on quality of life and sustainability, through education actions. (2016d) SMAPU is the Municipal Deputy Secretariat on

Urban Planning, which aims to implement urban planning policies and activities to promote sustainable urban development in the city. (2016j)

5.2.2. State Governmental entities

The state governmental entities have a more advisory and counseling role rather than executive role, in the committee, mainly because they have large experience in dealing with the subject of climate change. This can be perceived by the fact that they have inventories of GHG and the matter embodied in their organization culture and values, and also due to having some structured actions to mitigate climate change. Those entities are also present in the meetings of the Political Committee on the State Plan for Energy and Climate Change of Minas Gerais – the correspondent committee of CMMCE at the state level.

SEMAD

SEMAD is the State Secretariat on Environment and Sustainable Development and is responsible for planning and coordinating the state policy of protection and conservation of the environment and management of water resources, and coordinate environmental resources management policies. Within its powers is the planning of integrated environmental management in the state, consolidating technical norms on environmental matters, promote the implementation of legislation and specific standards of environment and natural resources, coordinate and monitor environmental actions, execute the environmental and water management policy of the state, and establish technical, financial and institutional cooperation with international entities and organizations to promote sustainable development. (SEMAD, 2016)

CEMIG

The state power company, which is 50,98% state owned and 49% private capital, is one of the largest power companies in Brazil, with activities mainly in Minas Gerais state. The company's concession area is nearly 96,7% of the state, owning 52 power plants, supplying power to more than 17 million people over 774 municipalities, including Belo Horizonte. Around 99% of all power generation from CEMIG is from renewable sources such as hydro, wind and gases industrial processes. Compared to the national and international average, the company has very low levels of emissions due to its production. The company's investment in renewable energy is far beyond its own production, the company also invests in other companies which work directly with renewables, like the company Renova Clima. Additionally, the company shows its interest on

development of low-carbon technologies for energy and the risks and opportunities of climate change. The company voluntarily produces reports to CDP (Carbon Disclosure Project), an organization based in United Kingdom working on disclosing companies and cities reporting on GHG emissions. CEMIG also invests in reducing the GHG of transportation in its value chain and in innovative projects such as implanting *Smart Grids*. (CEMIG, 2011, CEMIG, 2016)

COPASA

Similar to the power company, COPASA, the sanitation company of Minas Gerais is a company with 51,13% of shares owned by the MG state and 48,87% by private initiative. The company provides running water, sewage and waste services. The company, together with SLU, coordinates the water and sewage services in Belo Horizonte. The company has in its core had an Environmental Management System since 2005. With actions unfolding from its environmental policy, the company participates in several forums regarding environmental issues in Minas Gerais, CMMCE being one of them. Climate change is a matter that has been already been treated by COPASA, which has its own internal committee – Comitê Clima – to address the issue and implemented the program of GHG emissions' reduction. This programs dialogue with the internal risk management process. Comitê Clima is responsible for reporting the annual GHG emissions of the company, considering operational and administrative activities, seeking to improve its environmental management concerning climate change. (COPASA, 2016)

5.2.3. Civil society representatives

Ponto Terra

Ponto Terra is a non-governmental organization institutionalized in the form of a civil society organization for public interest (OSCIP). OSCIPs are NGOs that are able to act in partnership with the public power, with the possibility of using public resources through partnerships established in contract, regulated by the federal law 9.790/1999. (Federative Republic of Brazil, 1999) The organization was created to fulfill the needs for practical actions to improve quality of life, promoting sustainable development. The organization sponsors seminars, courses, and lectures to promote environmental education. Its current president is Ronaldo Vasconcellos Novais, the sitting member at CMMCE, and former vice-mayor of Belo Horizonte.

Nossa BH

The NGO was created in 2008 by an association of citizens with the purpose of building a fairer, more democratic and sustainable city. By promoting spaces for the dialogue between the social actors in Belo Horizonte, the organization aims to build a common agenda with a set of indicators, for allowing the diagnosing of issues, planning, monitoring and social controlling processes. The organization has developed a set of 73 indicators divided in 18 categories to follow up the development of the city, describing the challenges and inequalities of the city. The organization also aim to pressure the government actions to promote sustainability, by monitoring the public actions and having representatives engaged with key issues regarding the city's development. (Nossa BH, 2016)

Others

The other representatives of civil society belong to universities and industry associations. The role of the universities within the CMMCE is of great significance, for giving on the academic view and analysis of the city. The sitting member, Elizabeth Marques Duarte Pereira, is a highly qualified PhD in Chemistry, that coordinates projects on Energy, solar power, energy efficiency and others. (Pereira, 2016) FIEMG is the Industry Federation of Minas Gerais State, representing the industry interests locally, regionally and nationally. The organization provides support in key areas, such as economy, tax, environment and labor with lectures, workshops and courses. The federation has an Environment Department, that is increasingly engaging with climate change issues, disseminating within the industry the assumption that mitigation actions can create financial and reputation gains. The organization assists industries to identify and adapt to the associated risks of climate change, as well as to a more restrictive legal framework, aiming to strengthen the industry in a more effective and competitive way. The federation holds a seat in both municipal and state committees on climate change. (FIEMG, 2016) SINDUSCON is the representative of construction industry in Minas Gerais. The organization acts to protect the industry interests, supporting the assessment and solution to problems in the sector. It is divided in different commissions, and its Commission on Environment is responsible for acting to safeguard environmental sustainability in buildings. (Sinduscon-MG, 2016) The last member is CREA-MG, the Regional Council on Engineering and Agronomy of Minas Gerais is a federal autarchy that regulates and monitors the professional actions of engineers, geologists, geographers, meteorologists and agronomists. It also, has the mission to safeguard the social and human interests

in promoting the professional appreciation, sustainable development and excellence in services. The organization has a commission to discuss issues related to environment and hydric resources. Recently, the organization promoted a Seminar on Climate Change, with perspectives of several technical and academic specialists on climate change and the SDGs, in order to raise the awareness for the need to mitigate climate change with, for example, industrial actions in sustainable buildings. During this seminar, the professionals associated with the organization signed a document with the UNOPS representative declaring their interest in making the commitment to the SDGs. (CREA-MG, 2016a, CREA-MG, 2016b)

5.3. PREGEE and CMMCE

The PREGEE was compiled and institutionalized with the idea for it to be a perennial instrument of the policy, defining clear responsibilities in its implementation by the municipal government. It was also thought to aggregate different stakeholders to democratize the process, fulfilling the interests of the society thinking on a resource optimization logic. Another feature of the plan is the possibility of reexamination of its actions and the constant construction of knowledge, resulting in it not being a static plan. Therefore, the plan was thought to fulfill three basic policy features: institutionality, legitimacy, and dynamic. (Prefeitura Municipal de Belo Horizonte, 2015)

The implementation of its actions *"depend[s] on the approval of laws, the regulation of decrees, actions of other agencies/offices of city hall, as well as state and federal [agencies/offices]*, not being a responsibility of CMMCE. (Carvalho, 2016) However, the committee has an advisory and monitoring nature, aiming to evaluate and monitor the proposed actions, assured by Decree 15.690/2014. In this sense, the committee encompasses members from the governmental agencies which are responsible for its implementation, such as SMMA, SUDECAP, SLU, BHTRANS, COPASA and CEMIG. The committee is also responsible for the evaluation and revision of the actions in the PREGEE. Therefore, during the ongoing revision process, the actions are judged according their feasibility. (Carvalho, 2016) Another responsibility of the committee is the monitoring of the implementation of the plan's actions. According to Civil Society Representative 1 (2016), during a meeting in February this year, the creation of a fixed space in the plenary meetings for results presentation was presented, as fruit of the monitoring processes of each WG. The composition of the committee is regulated by decree 14.474/2011, with nominated representatives through administrative resolutions. Currently, the organization of the

committee is thinking on reorganizing the members and representatives in order to promote better representation and attendance to the plenaries and WG meetings. (City Government Representative 1, 2016b)

5.4. Belo Horizonte paving the way to climate mitigation

Belo Horizonte and its own initiatives to reduce GHG emissions and pursue a pathway to sustainable development are being recognized internationally, and it can be pointed out as one of the most important and complete actions towards mitigation among Brazilian cities. Considering the composition of all sectors emissions, and on what was showed in Figure 4, 53% of the city's emissions in 2013 are from road segment in transportation. The air transport segment was responsible for 18% of total emissions, therefore, the second largest contribution for the GHG emissions that year. The third main emissions sector was the Sanitation and Waste sector, being responsible for 9% of total emissions, followed by residential power 8% and commercial/institutional buildings power 6%. The industries were responsible for 4% of the emissions and the sewage for 1%. (Prefeitura Municipal de Belo Horizonte, 2015)

It is important to take into account the composition of the emissions' profile in Belo Horizonte when planning the reduction targets, in order to plan for a sustainable long-term development. As seen, the transportation sector was the responsible for the biggest share of emissions in 2013, and it is constantly increasing. In 2014, the light vehicles were the biggest share of the city's fleet, around 34% of 3.328.960 rolling vehicles were automobiles. (IBGE, 2016b) This scenario requires a consistent course of action from all stakeholders, government and civil society, involved in order to mitigate climate change, prioritizing the bottleneck sectors, but not conferring less importance to other sectors.

The international commitments made by Belo Horizonte are important to legitimize and enforce the transition to sustainable development. This is a remarkable step forward at the city level diplomacy regarding the subject amongst the Brazilian cities. However, it is important to state that the translation of what was agreed internationally to the domestic and micro level reality is a constant challenge. The city has established governance mechanisms and a legal basis for planning and formulating mitigation actions and policies, through the creation of CMMCE and the establishment of the climate change policy and its plan, PREGEE. This policy is intended to last across different mandates of government, as it was designed to be purposeful and long-lasting, but

not setting up specific measurable actions and targets yet. The PREGEE comes as a tool to translate this policy into actions.

The complexity of the city governmental structure, the place where policy is made and faces the individuals, can impact directly on the effectiveness of the policy planning and implementation. For instance, the governance mechanisms, actions and actors, are tied to their budget and to the governmental plan, in which the municipal government pursues the title of sustainable city. The way Belo Horizonte, the government and the citizens, are dealing and will deal with the climate change can impact on this goal. The analysis of the PREGEE's challenges and the stakeholders positioning regarding its planning and implementation, the focus of the next chapter, can lead to a clarification on how to achieve this goal.

6. PREGEE AND ITS CHALLENGES

The previous chapters defined the background where the planning and implementation of low-carbon policies occur, providing enough information for this analysis. The choice of PREGEE as the unit of analysis happened since it is a plan, with targeted measures to mitigate climate change. In other words, the PREGEE is the action plan for the Municipal Policy for Mitigation of Climate Change Effects. This study only analyzes three of four axes of PREGEE: Transportation, Energy, and Sanitation and Waste.

It is important to restate that the availability of updated documents is a limitation of this study. The PREGEE proposals are analyzed according to the technical report released in 2013, and the governmental actions and budget are analyzed according to the PPAG, document release in 2014. It is acknowledged that the proposals in PREGEE and the budget foreseen in the PPAG suffered some changes. The extent of the changes cannot be analyzed because of the information of disposal, the PREGEE actions after revision were not compiled into one document, according to City Government Representative 1 (2016a). Due to time limitations, the Director Plan and the Municipal Organic Law were not analyzed in depth, thus the information regarding both rely on statements collected through the interviews.

PREGEE establishes 37 proposals within the 3 axes, transportation, energy, and sanitation and waste. The actions proposed to mitigate emissions in the city were crossed with the information regarding the current PPAG actions and planned budget, and the complete table can be found in ANNEX I, that provides more detailed comments regarding each proposal. It is also important to state that the PREGEE is previous to PPAG being issued. The proposals on transportation were divided into four categories: improvement of public transportation infrastructure; subsidized public transport system; promotion of the technological update of the rolling fleet in the city; and measures planned at PlanMob in a full investment scenario up to 2020. The proposals under the Energy axis targeted energy consumption and the use of renewables. Last, the proposals on the Sanitation and Waste axis were more focused on sewage treatment, and on waste management, with just one action targeting recycling.

This chapter is based on the described theoretical framework. It is divided by the analysis dimensions on political implementation theory and the ISO 37120. The stakeholder analysis provided inputs to analyze all dimensions through the conducted interviews. Therefore, the

PREEGE implementation base will be analyzed according to the analysis dimensions in order to present the associated challenges. Then, some recommendations are made in order to pursue a full implementation scenario.

6.1. Local government capacity

The local government capacity is the governmental conjuncture in which the policy is inserted, such as the governance mechanisms through legal, financial and organizational capabilities.

6.1.1. Legal capacity

From the international point of view, the adherence to the Compact of Mayors oblige the city government to provide regular inventories of GHG and a plan of action to mitigate and adapt, constraining to make a vulnerability study. Currently, the city needs to present two reports for different institutions, Carbon and CDP, associated with the Compact of Mayors. The level of the requirements increases each year, compelling a critical self-examination, according to City Government Representative 1 (2016a). This can be exemplified by the fact that the requirements in those reporting systems now regard sectorial reduction targeting, when the PREGEE establishes global reduction targets. *"It is a hassle to not complete the reports in their entirety. But set sectoral targets requires a methodological change."* (City Government Representative 1, 2016a)

From the local level point of view, the municipal legal framework, discussed in the previous chapter, can be characterized as being relatively weak. Despite mitigation to climate change being added to the Municipal Organic Law, and there is already a municipal policy for climate change, this policy has a more general nature, not stating clear actions and/or targets. It is important to state that the overlapping of targets between the Municipal Policy and the Decree 14.794/2012 is concerning, and it should be adjusted in a way to promote a more homogeneous and strong institutional framework. This divergence was already pointed out in PREGEE's technical report and the matter was still not solved, characterizing a certain slowdown in the bureaucratic process. According to the legal system hierarchy, the Law should be amended, because a decree cannot overlap to a law. Ultimately, it was noticed that PREGEE and the governmental bodies are pursuing the target established in the Decree 14.794/2012.

The PREGEE as the object of this study makes it important to discuss the existence of laws institutionalizing the PREGEE and its actions/proposals and how this can impact directly on the

effectiveness of its implementation. When asked about their position regarding climate change, Civil Society Representative 1 (2016) answered that *"I consider relevant and imminent deployment of effective structural actions to address this issue, which has been largely used only as a political discourse. The implementation of public policies being delayed under the influence of the interests of capital"*. Implementing actions to mitigate climate change and institutionalizing them is extremely important to make the transition from merely political discourse to effective action. Laws and decrees are the long-lasting means of institutionalization and enforcement of these actions.

On the other hand, according to Nossa BH representative, Guilherme Tampieri (2016), the policy already allows the city to incentivize actions for mitigation, and he does not feel the need to institutionalize all the actions. On the municipal budget law there are no amounts designated for climate change, characterizing the lack of political interest on mitigating climate change. He also criticizes the process in which the policy for climate change was made, both the Municipal Policy and the addition of climate change in the Organic Law, without any consultation with the population. In his opinion, this gap in the policy making process is the most harmful to the population, because the actions are being conducted in a very technical way, forgetting the population.

Thinking about the timeline of events, before starting his second mandate, Márcio Lacerda could have added the PREGEE's action into the current PPAG. In a sense, the complex process of institutionalization of the PREGEE's proposals gives a relative weakness regarding what will be proposed in the next mandate. The uncertainty regarding a political scenario of just four years of mandate, such as those in Brazil, impacts directly on the planning regarding climate change in the PREGEE.

The public administration has advanced in this matter. According to City Government Representative 1 (2016a), some progress has been achieved in recent years, placing PREGEE and PlanMob as a state policy, and not only a government policy. The state policy is the result of the consciousness of political class and the society about the climate change, therefore, even if there is a shift of mindset, the current government or the next government cannot distort its principles, creating stronger institutional ties. This status was achieved when the Municipal Conference of Urban Policy put this on the table, as it established guidelines that have force of law. Currently, the Director Plan and PlanMob are being reviewed as a consequence of this conference. The Director

Plan incorporates the notion of dealing with transport for development, which is close to the mitigation logic. The Director Plan also incorporated the matter of environmental sustainability and the mitigation of climate change, which demanded the change in the Municipal Organic Law. Even the Director Plan changes due to the voting process in the City Council, but those issues are already incorporated in the Municipal Organic Law, which is apparently a unique event in Brazil.

However, this Conference needs to be legitimated by the legislative power. According to Tampieri (2016), the bill concerning the changes accorded in the Conference has being processed for over a year in the City Council, if this bill is not voted on within a month, the municipal electoral period comes and no other bill can be approved, throwing away seven months of work by the civil society and the industry during the Conference. He also believes that the city hall does not have any interest in approving the Director Plan and negotiating this process with the city council, delaying the economic development of the city through the delaying the approval of the Director Plan. Also, according to Tampieri (2016), there is no participation by the city council within the committee, and the climate change does not have a specific discussion forum at the city council.

From this study's point of view, there are just 7 laws and decrees institutionalizing actions for specific targets in the three axes studied in the city, and of this total, 6 already existed before the publication of PREGEE. This can be interpreted as a structural difficulty to institutionalize the actions of PREGEE. However, this institutionalization process is not only made through direct and dedicated laws and decrees, but they can also be present in the Director Plan, as a result of the PPAG. Since the Director Plan could not be analyzed, the PREGEE's actions that have some correspondent action in the PPAG are few. Out of 37 of PREGEE's actions, 20 do not have any correspondent actions within the PPAG – 14 of the 25 total actions on transportation, 5 of the total of 6 actions on energy, and 1 of the 6 total actions on sanitation and waste. Since the PPAG set up the municipal priorities, it can be said that the Energy and Transportation are not prioritized equally to Sanitation and Waste given the weight of the actions. This can be due to the sanitation and waste sector being more consolidated in the urban planning mindset.

Yet, the legal framework of the city regarding climate change is still embryonic, as presented in the discussion, not aiming the PREGEE specific actions and targets. One piece of evidence is pointed out in an interview by Civil Society Representative 1 (2016), talking about the non-approval of the bill regarding the use of solar power in new buildings. Despite the lack of a

law regulating the use of solar power to heat water, Belo Horizonte won the title of *National Capital of Earth Hour* by WWF in 2014 and 2015, and it is running for it again in 2016. This nomination is sustained by the voluntary use of solar power by the population and also by the use of solar power in the revitalization project of the soccer stadium due to technical requirements to hold the World Cup event in 2014.

Another constraint indicated by some informants was the difficulty with finishing the PREGEE, because the subject-areas are in constant evolution, thus providing some uncertainties in the process of planning/revisiting the actions. Therefore, until now, there is no document compiling all the actions of PREGEE after the revision process, only simple internal reports of the WGs. This is also a constraint to this study, thus this analysis was made according the public version of the PREGEE actions on a document elaborated by Prefeitura Municipal de Belo Horizonte (2013b). Together with the weak legal framework discussed before, this is a clear weakness of the plan and impact directly on its implementation. Once the action is incomplete and institutionalized, it is more difficult to put into practice.

6.1.2. Financial and Organizational Resources

Another aspect that has to be investigated is the government financial and organizational resources for planning and implementing PREGEE. Normally, the financial and organizational resources are interdependent, since funding impacts on the staff to address climate change.

It is important to analyze the organizational capacity of the government on what concerns the PREGEE. In the executive power, the three main axes are distributed over secretariats, state entities, and municipal superintendences and companies in order to reformulate and implement the actions. The Sanitation and Waste axis is under the SLU and COPASA umbrella. The SMMA and SUDECAP coordinate actions under the Energy axis with the help of CEMIG. The Transportation axis' actions are implemented under BHTRANS. The presence of qualified personnel to address climate change is essential to promote the agenda and implement mitigation actions locally. Currently, the CMMCE embraces members of each governmental agency that are chosen according to their interest and commitment to engage with the issue, since the participation in the committee is voluntary. Therefore, one of the advantages of the committee's representativeness is the possibility to promote the climate change agenda to the governmental agencies, being capable of building a bridge between the committee and the agencies.

However, it is important for the committee members to also hold influential position inside their agencies. This is because the PREGEE's actions are not necessarily seen as mitigating actions by the government agency, for example the waste management actions and SLU. Those are thought of by SLU as a way to solve the waste problem, not as an action that will mitigate climate change. The actions of BHTRANS are intended to solve the problem of mobility, but the design of these actions at PlanMob, for instance, are tuned with the alternatives available for sustainable mobility, also achieving the reduction of emissions. BHTRANS representative is a key player in the discussion about improving mobility inside the agency. In this sense, it is easier to interconnect the agency's internal plans with PREGEE goals. As an outcome of this interconnection of agendas by one key player in BHTRANS, it was clear that PlanMob and PREGEE converged strongly. (City Government Representative 1, 2016a)

On the other hand, not all secretariats that compose the committee have the role of implementing the actions, which does not exclude the fact that they could help with their expertise. According to Tampieri (2016), the secretariats do not conciliate their role and importance to the implementation of PREGEE. That is the case of the SMED, that could support environmental education in the municipal schools, achieving a key audience for raising awareness against climate change, the children. And the case of SMSA that could support with campaigns related to the waterborne, vector-borne, and respiratory diseases, relating to climate change, in order to reduce the social vulnerabilities encompassing these subjects. Also, the changes in the political leadership within the secretariats and superintendences that are responsible for implementing the actions is an institutional challenge, like the changes with the leadership in SLU, which can incur some delays. (City Government Representative 1, 2016a)

But the lack of resources to hire technical staff for the committee, as well as for the agencies, is a problem to overcome. As pointed out by City Government Representative 1 (2016b) and Tampieri (2016), the voluntary nature of the participation impacts in the presence in the plenaries and working groups' meeting, impacting directly in the implementation process of PREGEE. Currently, the vulnerability study is being made by a private company, as with the city's emissions' inventories were made, because of the lack of human resources with technical knowledge on methods and tools to measure climate change. Part of this problem is expected to be solved by the adoption of CLIMAS, the interactive and cooperative online and real time platform on emissions. Nevertheless, it is acknowledged that the governmental agencies do not have the technical capacity

to discuss in depth some of the thematic areas of climate change, such as monetarization of carbon. The possibility of revisiting the members' composition has been discussed within the committee, in order to increase the participation of the members and the representativeness of civil society. (City Government Representative 1, 2016a, City Government Representative 1, 2016b)

Regarding the funding capacity, it is important to acknowledge that the complexity of the Brazilian governmental structure is a challenge to overcome. The top-down financial structure in Brazil (embodied in the National Fund on Climate Change) also does not support, in practice, the municipal action on mitigation. Currently, the complicated political scenario in Brazil, with president Dilma's impeachment process and a temporary government, makes all multilevel governance processes more complex. The uncertainty regarding federal budget for financing strategic municipal infrastructural changes, like the PAC projects, can impact directly on the effectiveness of implementing climate change policies and actions.

This is especially true regarding the actions under PlanMob. The restructuration of the transport system in Belo Horizonte requires a great volume of financial resources, for example, to enlarge the metropolitan city rail system – the city does not have plans to create a line of subways, but surface metropolitan trains, therefore, the chosen translation was metropolitan railway system. In the opinion of City Government Representative 1 (2016a) *"the PAC resources will not come, thus most of the actions that were forecasted in a full investment scenario will not happen, and, maybe not even these in a conservative investment scenario. The city trail, which involves all governmental spheres, will not happen."*

The funding system for PREGEE was perceived as very fragile, since the federal government fund for climate change and its funding for related areas through PAC, are not currently being destined to PREGEE actions. Resources from the National Fund on Climate Change were never destined for climate change mitigation actions promoted by the municipal government in Belo Horizonte. According to what was reported by the City Government Representative 1 (2016a), in 2014 happened the First Journey on Cities and Climate Change in Belo Horizonte, supported by ICLEI. There were federal government representatives present to explain the structure of the fund but it did not open doors to local governments to make use of this fund. Apparently, by then, it was only interesting from the federal government's perspective to finance projects in which cities would promote consortial comprehensiveness projects to mitigate

climate. This is perceived by City Government Representative 1 (2016a) as being complicated, given the current maturity levels of each city's climate change discussion. The cities are still building their own capacities to address climate change, the idea of consortial projects now is insubstantial.

The fund, that by law was created to, among others, finance climate change mitigation at the local level, does not fulfill its goal. The described non-cooperative scenario by the federal level to the municipal level is concerning. Nevertheless, after the signature of Paris Agreement and the Brazilian iNDC, it was expected that the federal government would start to actively cooperate with municipal governments in this matter. But due to the uncertainty created by a temporary government and the deep economic retraction scenario, this better cooperation is also uncertain it can be achieved.

Another source of funding would be through cooperative international networks for individual actions, such as PlanMob, as well as for the whole PREGEE implementation. It was reported by the city government representatives that there are initiatives from BH to search for fundraising through the cities' networks. The International Relations Secretariat has been working to promote Belo Horizonte and its plan for climate change in the international forums, such as COP21, the launch of SDGs and others. Individually, the agencies try to look for partnerships and raising funds through their own networks, e.g. BHTRANS and the PlanMob with the support of WRI cities Brazil.

In order to make a deep analysis regarding the funding, it would be necessary to go through the evolution of the resources directly and indirectly destined to PREGEE's actions. Initially, that was part of the research plan, but due to lack of publicly available documents that were complete, and the time-space constraint of the investigation, this characterized a strong limitation of this study. Yet, Tampieri (2016) stated that, currently, there is no governmental budget to address climate change. The budget presented in ANNEX I is just an estimation of the total budget for the set of actions within the PPAG's proposals. Thus, two considerations are needed. First, that the budget was not intended just for that one proposal, but for the set of proposals within the 12 subject areas. Second, the budget presented on ANNEX I was not necessarily applied for the implementation of those proposals.

6.2. Local framing

It is equally important to analyze the city according to its capacity for local framing. Local framing is the people's ability to relate the climate change to local problems, and how climate change would generate socio-economic or environmental welfare. This perception can directly affect the effectiveness of the planning and implementation processes of PREGEE. According to the policy implementation, it is crucial to involve the civil society in the policy making process, in order to make it more reliable, and to bring their attention to the subject and how relevant is it to their future lives. Civil Society Representative 2 (2016) states that *"Public opinion of Belo Horizonte is of secondary importance in relation to the subject. The population even has information about it, but does not act to reduce the effects of climate change."*

Tampieri (2016), has a critical view regarding the ability of the government to communicate with the civil society in a more comprehensive and inclusive way. This impacts directly into the civil society acknowledgment and understanding of the climate change issue. This category of analysis, among the other three, is the one that is the most problematic as to what concerns PREGEE's planning and implementation.

6.2.1. Relation to local problems

One of the problems most mentioned by interviewees was the lack of a communication plan with the society. It is understood by some of the committee's members that the society needs to understand the effects of climate change in their lives. This is confirmed by this statement *"it is important that society understands that climate change will be responsible for a greater water and food shortage, mainly in developing countries, besides the flooding of several locations, extinction of marine species, amongst others."* (Carvalho, 2016)

When giving the following statement, Industry Representative 1 (2016) explains how their perception is on how the anthropogenic action contributes to climate change, *"the recent water crisis faced by Minas Gerais, having as one of the possible causality factors the climate change. These events strengthen the idea that climate change is an anthropogenic aspect and signals attention to all sectors."* (Industry Representative 1, 2016). It is important to use this technical knowledge and translate it into a simple language for the society.

Also, there is a clear understanding that the society in general does not relate to the problem, and sometimes has misinformation relating to climate change and its effects. *"In Brazil, as in much*

of the world, there is a shy disclosure about the importance of addressing the issue of climate change. Unfortunately, there is a lot of information disconnected with reality and often the media (print, TV and online) disseminates misleading and biased data and research. The population does not have a suitable channel for mass dissemination [of information] climate change with accessible language." (Carvalho, 2016)

In terms of the industry, Industry Representative 1 (2016) stated that the profile of the industries in Belo Horizonte, 90% are micro and small industries, which distances these companies from the climate change agenda. Since they are not energy-intensive industries, they have very little impact on the municipal GHG inventory. This results in very few initiatives that are related to the industry in the city. *"We also have the perception that among the environmental subjects, climate change is the subject that is the most distant from the business reality as there is a difficulty in understanding the direct relationship with the industry"* (Industry Representative 1, 2016)

The way the people relate to climate change and the associated effects in their lives is varied according to the people's profiles, e.g. a high-educated citizen understands the subject in a different way than a less-educated one. Nevertheless, it is important to take into account the different targeted audiences when elaborating the communication plan to the population. "*I believe it necessary to spread this subject in different ways and focused for each target audience. We cannot think to disclose the issue of climate change for the entire population with the same language."* (Carvalho, 2016) This is due to the necessity of reaching all layers of society.

The assumption of needing this sort of communication plan is something that already exists with the committee members. Last year, the Frameworks Institute, an organization that works with solutions to communicate ideas that are difficult for society in general to understand, mapped the scientific knowledge regarding climate change, and the general knowledge society has about it. The organization ICLEI, the cities and some NGOs were interested in the model, and first was thought to be financed through a NGO that funds Nossa BH. However, this NGO withdrew from the project and it could not progress. There are no internal resources available for a communication plan, thus, some members of the committee are starting to make a series of infographics regarding climate change to make it available publicly. Some minor actions to communicate with the society are already made, like the initiative to participate on We Love Cities award of WWF Brazil. (City Government Representative 1, 2016b, Tampieri, 2016)

It is also important to focus on the communication of the work of the committee. "*Concerning the disclosure of CMMCE's work itself I believe it can be improved, given that the majority of the population is unaware of the committee. However, there are some proposals from NGOs for a communication plan, it all still very embryonic. Either way the committee believes that the disclosure should be improved and there is at least the intention of seeking alternatives to what is built accordingly. I believe that with the participation of NGOs or another external agent is possible to further disclose the issue of climate change and the work of the committee.* (Carvalho, 2016)

When asked about the ideal way to deal with this challenge, Carvalho (2016) said *"an approach that usually gives fantastic results is child education. Children are very efficient multipliers, since they learn at school, pass on to family and still require them to change their habits."* Which leads to the problem of the secondary role of the SMED in the CMMCE, discussed on section 6.1.2, that could use the education network to promote knowledge about climate change.

In addition to a lack of understanding of the connection between climate change and health issues, there is also a lack of understanding of the relationship with other areas covered by the ISO standard used in this thesis, such as economy, urban planning, governance and education. Directly or indirectly, those indicators can be affected by action to mitigate climate change. The understanding spread by the SDGs, that mitigating climate change is a step towards eradicating poverty.

6.2.2. Generate Socio-economic or environmental welfare

One way to raise awareness of the society, is relating the climate change effects and opportunities to their lives. The lack of this understanding about the economic and environmental opportunities that could be generated by mitigating climate change was perceived in both civil society and the government, supported by the data collected during the interviews. First, the society still do not relate the adverse effects of climate change, and how this can impact on their welfare, meaning it is still intangible to the individual. That is the case when the society understands the need to recycle, but do not want the recyclables collecting points near to their residences, because it causes them a sort of discomfort. (City Government Representative 1, 2016a)

On the other hand, the society in Belo Horizonte, have demonstrated some voluntary actions to use renewables source of energy. According to Carvalho (2016), there has been an increasing

use of solar power for water heat in the residences in Belo Horizonte for almost 20 years, without any regulatory framework for that. That is because the population saw an economic advantage in this technology.

When Civil Society Representative 1 (2016) states, *"the implementation of public policies [are] being delayed under the influence of the interests of capital"* it implies that local framing is lacking from the government part, lacking an association between the mitigation actions to economic gains in the long-run. This can also be evidenced by the perceived opposition by both executive and legislative powers to regulatory frameworks that promotes tax incentives for the use of renewables by companies and buildings. Also by the fact that there is a lack of discussion about the carbon monetization mechanisms, such as carbon tax. This lack of discussion is caused by the fact that the city is just starting to acknowledge the climate change problem, and do not have organizational capacity and knowledge to promote this issue within the governmental agencies (including the planning and finance secretariats).

6.3. Political actors and factors

The role of political actors and factors impacts directly on the effectiveness of developing and implementing climate change policies, in our case, the PREGEE. First, it is important to understand the role of the political leadership through the political entrepreneur. Then, it is important to analyze the influence of interest groups. Last, it is important to analyze the role of political parties.

6.3.1. Political Entrepreneur

The political entrepreneur is the figure of the political leadership that is engaged in promoting the climate change agenda both in and outside of the city. According to City Government Representative 1 (2016b), Belo Horizonte has it embodied in the mayor, Márcio Lacerda, the figure that represents the local executive government. During his first mandate, the SMMA was upgraded from Deputy Secretariat to Secretariat, a big step in recognizing the importance of environmental subjects. Another important character pointed to by this informant was the former vice-mayor and Municipal Secretary of Environment, Délio Malheiros, who was a great propelling to the municipal climate change agenda. He is a diplomatic figure, who can articulate and present the subject and Belo Horizonte's actions in a good manner, both nationally and internationally. He gained the appreciation of the organizations and institutions to which he

related and promoted Belo Horizonte's initiatives. Another figure that was important in creating and consolidating the committee, was Ronaldo Vasconcellos, Ponto Terra representative and former vice-mayor and environment secretary. (City Government Representative 1, 2016b)

The mayor initially did not confer importance to this agenda. But last year, he took office as head of the National Front Mayors, which promotes, amongst others, the environmental agenda for cities. Also last year, after the COP20 to COP21 there was a strong action from the organizations, after which the mayor recognized this as an important agenda, being present on COP21, SDGs meeting and signed the Compact of Mayors. (City Government Representative 1, 2016b) It is known that the political entrepreneur needs an organizational structure that allows the engagement with climate change, such as transnational networks, like ICLEI and C40 cities. The Municipal Deputy Secretariat of International Relations has provided this assistance for the executive power, being present in several international meetings and keeping international cooperation networks. However, the budget, as pointed out in Chapter 4, is a constraint and a challenge to overcome, as this issue is not considered priority by the government.

The presence in international meetings regarding the subject is a step forward, but there is a need for the political entrepreneur to translate what was discussed in the international arena to the domestic political scenario. Being able to politically promote the idea and lobby the different spheres of government is a crucial characteristic of a good political entrepreneur. For a full implementation of climate change policies, it is necessary to translate the rhetoric into practice.

In order to evaluate this capacity, his government proposal for the second mandate and the current government plan were analyzed. On both Governmental Program and Governmental Plan, Márcio Lacerda and his former vice, proposed actions to mitigate climate change and increase the participation of the society in the policy making process regarding sustainability, increasing action on environmental education through SMMA up to 2030. The governmental program on *Sustainable City* states that *"Belo Horizonte needs to consolidate a model of urban development by 2030 [that is] environmentally sustainable, characterized by the quality of its hydric resources, preservation of green areas, reduction of greenhouse gases' emissions, and energetic efficiency. […] We want to build a city in which people of all social classes participate in the great collective effort of guaranteeing sustainability to the urban environment, as the result of an audacious project which involves changes in the society's behavior, and creative solutions of space organization."*

(Lacerda, 2012). This political statement needs to be put into practice to characterize the government representative as a political entrepreneur. Yet, in practical terms, it is described by some informants, that the environmental theme and education are treated as a secondary issue. (City Government Representative 1, 2016a, City Government Representative 1, 2016b, Tampieri, 2016, Carvalho, 2016, Civil Society Representative 1, 2016)

The political entrepreneur does not need to be necessarily part of the executive, they only need to have the ability to dialogue with all the interested parts promoting the climate change agenda. There is also the need to be able to change the mindset of the involved parts, organizations, government, and civil society, to treat this issue with priority in the political agenda.

6.3.2. Influence of Interest Groups

While the coordination between different governmental agencies and spheres (local and regional) is already complicated regarding any simple subject, it is even more complex regarding climate change, a cross-thematic issue. Every governmental agency has its agenda, while they have to join efforts for mitigating climate change. The crosscutting between agencies and other stakeholders is a challenge to overcome, but having the CMMCE as a forum to discuss climate change in Belo Horizonte is a step forward to a better implementation.

In an informal conversation with City Government Representative 2 (2016b), their opinion was that the biggest problem of the CMMCE, and thus the PREGEE is the lack of cross-cutting between climate change, the focus areas and the stakeholders who represents the municipal government, in order to put it into action. Despite the fact that the CMMCE is seen as a fruitful arena to support the cooperation between the stakeholders, it still fails to promote the level of coordination needed to build and implement strong actions against climate change. This can be evidenced in two statements. First, through a statement from a civil society representative. *"The collegiate structure allows a broad process of consultation with various stakeholders related to climate change and the city of Belo Horizonte. Thus, the participatory process gives legitimacy to the actions related to implementation of municipal policy on climate change."* (Industry Representative 1, 2016)

And, the statement of City Government Representative 2 (2016b), *"My vision is, despite it [CMMCE] being formulated in a multi-sectorial and multi-stakeholder way, is that [the committee] still does not reach the level of cross-cutting needed. This climate change policy still cannot*

influence the actions of those areas which are part of the committee much. With exception of BHTRANS, which has the PlanMob, which considers the [emissions] inventory and the fact that [the transportation sector] is the main emitter. The other sectors do not let [themselves] be influenced much by the inventory, so we are still in the mitigation level for climate change understanding." This statement evidences that there are some coordination problems between the agencies on what concerns the PREGEE actions, and, at the mitigation level, there are still some improvements to make.

According to the theory, the social coalitions can support or conflict the climate policies. Their articulation and degree of participation can impact on the local government response to climate change, directly impacting the effectiveness of the policy development and implementation. The stakeholders analyzed here were, somehow, connected to PREGEE and the CMMCE, being part of the meetings and working groups at some point. The stakeholders were mapped according to their salience and power regarding the PREGEE and CMMCE, the complete organization of the results can be found in ANNEX II.

Since the analyzed stakeholders were part of the CMMCE, and according to information gathered in the interviews, most of the stakeholders have medium to high interest on PREGEE and its proposals. The data collected were two different power spheres, one is the decision power inside the committee, the other is the power to implement the PREGEE actions. Regarding the power of voice/decision inside the committee, all interviewees said that every actor has its voice taken into consideration, therefore, all have high power of decision. That can be confirmed by the following statement, "*the space that the CMMCE designates to the population is democratic, the subjects are treated in detail and carefully [according] to people's needs, aligned to the environment […]. The construction of the meetings, debates in plenary, the development of documents and monitoring of issues related to climate change are carried out with the participation of all and there are no agents that overlap in these activities."* (Carvalho, 2016)

The stakeholders which have high interest and high power to implement the policies were considered promoters. They are SMMA, BHTRANS, SUDECAP, SLU. The stakeholders with medium interest on the PREGEE are stakeholders that are government representatives that do not have clear tasks to implement the actions and relate to the climate change issue in low-level (acknowledge the issue, but do not strongly relate their actions to impact the mitigation of climate

change). SMSA, SMED, SMAPU, SMAGC, URBEL were considered defenders giving their medium interest in the matter, but lack of power to implement the actions.

The City Council is something to consider separately. That is because the representative of the City Council at the Committee is interested in the issue, however this is not true for the majority of counselors, thus, their interest was classified as medium to low. Therefore, if the city council representative, Sérgio Fernando, was considered alone, he would be classified as a defender, because he does not have the power to implement/promote the issue strongly in the City Council. According to City Government Representative 1 (2016b), having one representative at the committee does not necessarily mean that you have contact with the full representation of the legislative branch. Yet, the majority of representatives of City Council are considered latents, since they hold power to institutionalize the actions (high power in the implementation process) but lack interest in the issue, which, despite not explored in depth in this study, is presented in the next subsection.

The stakeholder that are part of state government entities were considered *soft-promoters*, that is because they have a role in the committee that is to guide and assist the decisions within the committee associated to the fact that CEMIG and COPASA are key agents to implement actions on energy efficiency and sewage treatment, respectively. But their interest is limited to a more regional approach, and their power is limited to few actions. Therefore, they were considered promoters, but with a smaller impact in the policy itself, thus, soft-promoters. When asked about their participation in the committee regarding the members' articulation, State Government Representative (2016) answered *"Being only a consultative body and leading participation of PBH's agencies, I never participated in any articulation. [In] the meetings I attended there was virtually no debate regarding the issues presented. […] As I said before, this committee is advisory and composed of organs that has a majority in the PBH. The proposals submitted in PREGEE, [the state entity] is not a structuring agent and is not strongly affected. So basically I seek to opine on matters familiar to the energy sector in order to contribute to the discussions."*

Regarding the civil society representatives, it was identified that they have high interest in climate change policies, but low implementation power, being considered defenders. The role of all representatives of civil society is very important to the effectiveness of the policies monitored under CMMCE being a bridge to the civil society. Belo Horizonte has a strong organization of the

civil society, and there is a tradition of dialogue with the government, demanding results, obliging the government to reshape their planning processes and reporting results. (City Government Representative 1, 2016b)

For example, the universities are essential to promote knowledge regarding the issue, evidenced by this statement, *"the role of universities is essential in identifying problems and solutions relevant to the topic, the training of differentiated leaders and decision makers by [raising] the awareness and knowledge of innovative technologies and applications"* (Civil Society Representative 1, 2016) Also, the industry representative stated that they promote knowledge transfer to the industry community, in order to prepare them for a scenario of bigger obligations regarding climate mitigation actions. "*In the context of corporate mobilization, [industry] modulates its activities aimed at transferring knowledge and expertise to companies on climate change and industry. In this sense, on the subject of climate change are worked trends and future legal obligations (e.g.: GHG inventory) in order to prepare the sector for these issues. These actions are structured through lectures, workshops and courses, dissemination of information and guidance on the challenges and opportunities arising from climate change and carbon market, supporting business, trade unions, investors and other interested parties."* (Industry Representative 1, 2016)

The civil society representatives are an important tool to bridge the gap of knowledge between the committee/government and their daily lives, especially with what concerns a conservative society with conservative thinking, which a majority of Belo Horizonte is. Nossa BH have some structured actions to promote that bridge. The organization publicize a set of documents and indicators for the society to monitor the governmental action on its website. Its representative at CMMCE, Tampieri (2016), has a critical view regarding the city's efforts to implement climate change mitigation policies and actions.

However, one challenge to overcome is the attendance of members in the committee meetings. The current representatives of civil society have low attendance, excluding Guilherme Tampieri and Luciana Cardoso, due to their busy schedule. As discussed previously, the committee is thinking of a way to recomposing the committee, adding more civil society representatives. Apart from the committee, some secretariats promote the participation of civil society in their decisions. As in the case of the Waste and Sanitation axis, in which the institutional arrangements are

extremely permeable to the civil society, like groups of recyclables collectors. And the Transportation axis, that allows the participation of diverse actors in public discussions regarding PlanMob. (City Government Representative 1, 2016a) However, as discussed previously, regarding climate change, the policy making process does not include much the society, according to Tampieri (2016).

6.3.3. Role of Political Parties

The executive branch has a well-structured relationship with the legislative branch, through the secretariat of institutional matters, responsible for making this bridge. The executive power does not have major problems with passing matters at the City Council. Nevertheless, the political agenda and the interest of the political parties can affect the institutionalization process of climate change policies/actions, therefore, impacting on their implementation. According to City Council Representative (2016) there is no articulation about climate change inside the City Council. Currently, only two counselors are attentive to the subject, members of the Green Party (PV), Sérgio Fernando and Leonardo Matos.

Also there are very few bills regarding climate change, and *"unfortunately, this issue is not yet on the agenda of most Brazilian politicians, at all levels, not only in the City Council"* (City Council Representative, 2016). The current representative works *"to make a bridge between what is discussed and proposed in the committee and the creation and /or follow-up born bills in the discussions of the members"* (City Council Representative, 2016). That is because some proposals that are born within the committee are the responsibility of the executive power. It is the counselors' role to forward the proposal and work for it to be approved.

All these statements characterize a scenario of deep fragmentation of political interests on what concerns climate change. The matter is not strong enough to have significant representation in the legislative branch, with very few bills and proposals being made in the City Council, being a big challenge to overcome in the implementation process of actions, proposals and policies regarding climate change.

6.4. Benchmarking and ISO

ISO 37120 was first thought, in this study, to be a tool for benchmarking the city in one area, like transportation or energy, with another success case. However, during the research this was proven difficult to pursue in the timeframe and with the available data. Therefore, the standard

and its indicators were used to the extent that was possible for this study. But it is acknowledged that it is an important tool for the city to achieve the status of sustainable city, and it could help to improve the planning and implementing processes using the ISO 37120 indicators to measure the outcomes of the proposals and to pursue better levels compared to successful cases, that could be found on World Council on City Data – Open Data Portal.

Hence, the comparison through benchmarking is extremely important to follow and learn with best practices. It is important to learn from mistakes and successes. On the PREGEE technical report, three ways were defined to keep the benchmarking process: monitoring similar experiences nationally and internationally; associating to global platforms of GHG management; and maintaining the report structure related to PREGEE (inventories, reports to global platforms or WGs reports). (Prefeitura Municipal de Belo Horizonte, 2013b)

Currently, the city produces international reports on climate change emissions and actions to Carbon and CDP. What was pointed out by City Government Representative 1 (2016a) is that the reporting initiative is important for providing data and indicators, but also for provoking a critical reflection regarding how climate change is addressed in the city. The reporting system is evolving, and thus requires increasingly more detailed data and indicators from the cities, which can enforce the cities to keep improving their measurements and reporting. It is expected with the implantation of CLIMAS that more detailed and updated data will be available for the government, improving its capacity of reporting.

City Government Representative 1 (2016b) also states that the comparison process through benchmarking is now complicated, because the cities have different realities and profiles. However, if the city implemented ISO 37120 as their measurement standard for sustainable cities, a standard that comprises indicators to measure effectiveness of climate change actions, this benchmarking would be possible. Since *"this International Standard is designed to assist cities in steering and assessing the performance management of city services and all service provisions as well as quality of life. It considers sustainability as its general principle and resilience as a guiding concept in the development of cities."* (International Organization for Standardization, 2014b)

ISO 37120 is not designed to provide a certification, just a standardized measurement for city services and quality of life, aiming to help cities to measure their performance, enabling to learn with other cases by comparison and share best practices. Presently, a representative of PBH,

from the planning secretariat, composes the working group of ABNT regarding the ISO 37120 translation. When contacted, this representative informed that the city still does not have a formal position regarding the adoption of the standard. Despite this initiative seeming interesting, there are many challenges with adopt this standard, e.g. the lack of national or local database for accounting, for example, that comply with the international standards. (City Government Representative 3, 2016)

The analysis of the PREGEE's proposals were framed according to the related indicators of ISO 37120, which are indicators that can be directly affected by the proposal, hence, a measure of effectiveness of the proposal/project. The PREGEE's proposals are already institutionally weak because they lack importance within the government (executive and legislative) and because they depend on related existent actions from the governmental agency that is responsible for its implementation. And as stated previously, the PREGEE lack proposals that cover indicators such as economy, urban planning, governance, health and education. Those areas are directly or indirectly connected to mitigation of climate change, consequently should have correspondent actions under PREGEE. This fact only evidences that PREGEE proposals are considered to not totally embrace the areas that affect and are affected by climate change. As seen in ANNEX I, the analysis found out that only the following indicators could be related with actions/proposals under PREGEE:

- Energy: indicators 7.1; 7.3-7.5;
- Environment: indicators 8.1-8.5;
- Solid Waste: indicators 16.1-16.4;
- Transportation: indicators 18.1-18.3; 18.6; 18.8;
- Wastewater: indicators 20.2-20.5;
- Water and Sanitation: indicator 21.3.

6.5. Recommendations

It is important to mention that this recommendations section is intended to provide recommendations to overcome PREGEE's challenges. Despite its pioneering set of initiatives to mitigate climate change in Brazil, the city faces several challenges, as pointed out in the previous subsections. Some recommendations can be done in order to pursue a better planning and implementation of the PREGEE's proposals and actions.

The challenge with integrating the society in the efforts seems to cause a great impact on the planning and implementation. Thus, the first recommendation would be based on making a strong and structured internal communication plan, in order to create awareness and priority of the subject in all cross-cutting areas and secretariats. Then, with the joint efforts of all secretariats, promote an external communication plan, based on Frameworks initial research and focused on the different public groups. Efforts of SMED and SMAS are extremely important in order to corroborate with the communication plan in the municipal schools and health centers, raising awareness of climate change and its negative direct impacts on the public health and daily lives. It is noted that the city has a restricted or nonexistent budget to communicate with the society, thus some public-private initiatives could promote this plan through domestic and international cooperation.

Together with the re-composition of the CMMCE, already in process, the second recommendation to increase the participation of the population on climate change issue, and on the policy making process would be the creation of a forum inside the City Council regarding the subject, discussing bills and other matters to be voted. This would improve the participation of both a range of actors that are who neglected and neglect climate change as an important issue, the City Council and its councilors, and the civil society. This would strength the CMMCE's relationship with the legislative power, and narrow the institutionalization gap.

The third recommendation is also related to the participation of the civil society in building strong proposals and making effective actions to mitigate climate change. Based on best practices around the world, the use of educational didactic and inclusive projects in municipal schools, at first, could help the urbanization process. For example, the use of LEGO© and Minecraft© has proven to provide innovative solutions for urbanization issues, such as transportation, as well as land-use and planning. For example, the project GeoCraft, organized by Marianne Linde in the science center GeoFort. The project built a 3D map of the Netherlands with the help of the game Minecraft© and the participation of the civil society, especially children and middle-schoolers, to help to organize their own environment, providing sustainable uses and organization of the city's environment. (GeoFort, 2016)

The fourth recommendation is based on the use of ISO 37120 to benchmark with success cases around the world for sustainable cities, as discussed in the previous subsection, enrolling in

another network of cities, through the World Council on City Data. The sharing of best practices and benchmarking has been proving a good tool to improve control over the planning and implementation of climate change mitigating actions.

The fifth, and last, recommendation is the need to improve the city's knowledge on carbon financial tools, such as carbon tax and the carbon market. The monetization processes can be important tools to combat climate change, through the economic incentive for the government and for the population. Mechanisms of tax exemption can promote the individual action, such as the solar power bill, that had no power to be approved by the legislative and executive. As identified, the city still does not have enough maturity for this discussion yet, needing more specialized personnel to guide the monetarization mechanisms, and answer questions on how, for example, to use, measure, and price. The committee needs more technical personnel capable of bringing these kind of mechanisms into the climate change discussion arena of Belo Horizonte.

Apart from the recommendations that were derived from this study, the PREGEE technical report had already pointed out some measures to take in order to qualitatively and quantitatively improve the PREGEE's proposals. Regarding the Energy axis, these were pointed out: Incentive the use of energy efficiency like prioritizing the use of solar power for water heating; substitute fuels from residential and commercial/institutional sectors; enlarge the natural gas distribution to commercial/institutional and even residential to fuel thermal systems; adopt wind and solar power; enlarge the scope of Sustainable Seal BH – insert economic incentives, e.g. reduction of environmental compensation. On the subject of the Transportation, some recommendations were made: Increase pricing over fossil fuels on transportation; enlarge the options of transport and mobility less carbon-intense; increase restrictions for light vehicles to incentivize public transport in the city center; incentivizing transport options which are less carbon intensive. Concerning Waste and Sanitation it was recommended to: Focus on actions on CTR Macaúbas; invest in new processes for waste management (advanced thermal treatments and recuperation of biogas); enlarge the selective collection; invest in systems to recuperate biogas from waste and sewage management. Finally, some general recommendations were made: fix the legal framework regarding the overlapping of GHG targets – as mentioned previously; attract long-run funding through good publicity; and take inspiration from best practices of cities around the world. (Prefeitura Municipal de Belo Horizonte, 2013b)

The fact that those recommendations were not put into practice almost 3 years after the release of this report characterizes that the PREGEE and the committee have structural difficulties to overcome.

7. CONCLUSION

This study aimed to answer the question: what are the policy development and implementation challenges of the PREGEE in Belo Horizonte? In order to answer this question, the data gathered through documentary research and interviews were analyzed according to policy implementation theory, stakeholder analysis and ISO 37120. The policy implementation theory provided a set of analysis categories, supported by the tools and data gathered through the stakeholder analysis and the ISO 37120. The summary of the methodological framework and the operationalization of the theory can be found in ANNEX IV.

To answer the question about the implementation challenges of PREGEE, a plan to reduce GHG emissions at the municipal level in BH, a background of the Brazilian initiatives to reduce GHG and its insertion on climate change international forums was presented in Chapter 1. Belo Horizonte's initiatives on climate change and its governance mechanisms were presented in Chapters 4 and 5, setting up the municipal background for climate change discussion, and policy making and implementation. This background provided enough information, together with the data gathered in the interviews, to analyze the development and implementation process of PREGEE according three main dimensions: Local government capacity, local framing, and political actors and factors.

7.1. Main Findings

Despite Belo Horizonte's avant-garde initiatives on climate change in Brazil, the city faces several challenges to plan and implement climate change mitigation policies and actions. The PREGEE is the most realistic approach to climate change, intended to promote long-term and concrete results towards sustainability of the city and the mitigation of GHG emissions. However, this plan is costly and time-consuming, having several challenges hampering its effectiveness.

The financial and organizational resources are still embryonic, so some strategic structural changes are needed. Some municipal government agencies could have deeper responsibilities regarding the PREEGE's implementation, such as SMED and SMAS. However, it is known that the integration between the agencies efforts to implement the planned actions is still superficial and the lack of resources to hire specialized personnel affects this integration as well. The lack of municipal resources to PREGEE is something to be concerned with. It is understood that the structure of a municipal budget is extremely complex, however, the lack of exclusive resources for

this impacts directly on its effectiveness. The bureaucratic processes can slow down the development of certain actions. At the same time, the very marginal participation of the state and federal governments providing knowledge and budgets for PREGEE is a great challenge to overcome, especially regarding the transportation actions embodied in PlanMob and the lack of cooperation through the National Fund on Climate Change.

The lack of local framing by the civil society and the governmental agencies is another great challenge to overcome. If climate change and its effects are not understood by the agencies that implement the PREGEE actions, there will be a gap between the international commitments made and the effective action on local level. This fact can be tied of the lack of a figure of the political entrepreneur, capable to promote this cross-cutting agenda. It was also identified that the civil society does not have a deep understanding of climate change and does not relate its effects to their daily lives and how this affect their socio-economic and environmental welfare. The lack of internal and external communication plans for the PREGEE is something that affect this outcome.

In the same way that the federal government does not involve local level stakeholders in the policy making process, the municipal government does not involve the civil society to discuss climate change commitments and actions. The political actors and factors can directly impact on the effectiveness of PREGEE. The complexity of the governmental arrangements can be a real challenge to implement climate change actions and policies, and the existence a political entrepreneur to promote this agenda can be crucial for the prosperity of this agenda. It is known that the mayor and his former vice-mayor were publicly engaged with climate change. However, the political discourse is effectively put into practice, by lacking real political will or financial resources. Together with this weak figure of political entrepreneur, the influence of interest groups is something to remark. It was seen that the most influential stakeholders within the committee, either have low interest (e.g. City Council) in the agenda or face several structural constraints (BHTRANS, SLU etc.). Also, it was seen that the representativeness of the civil society is still very low, either because of busy schedules or because it does not comprise the diversity of civil society movements and organizations that Belo Horizonte has. The role of the City Council and the councilors is extremely important for the institutionalization of the actions. However, there is a lack of interest and knowledge regarding climate change in the institution.

The challenges are many, there is a lack of understanding on climate change by the civil society and the governmental bodies, a lack of political will and interest; and lack of funding. Hence, there is a need for joint efforts, from those who are willing to promote this agenda, to build the necessary framework for PREGEE to be implemented. The creation of the committee and drawing the plan were major steps, but building capabilities to begin overcoming the presented challenges is the major task of CMMCE and the stakeholders interested in this agenda.

Recommendations were generally made, with no technical scope (e.g. recommending some sort of methodology for waste management), based on the perceived challenges. First, it is necessary to build strong and coherent internal and external communication plans. Second, there is a need to improve the civil society participation in the committee, through its re-composition and the creation of a forum in the City Council. Third, is the use of educational and didactic tools, such as for example LEGO© and Minecraft©, to involve the civil society, especially children and young adults, regarding the use and organization of the city's environment. Thus, the first step to promote the benchmarking through ISO 37120 is made, but it is up to the governmental entities to adopt this type of tool to help to create a stronger path for PREGEE's planning and implementation. Lastly, the city needs to build a strong knowledge on carbon monetization processes, through national and international cooperation and hiring specialized personnel.

This thesis only sheds a light on the development and implementation of PREGEE's challenges. So it is expected that these acknowledgements provide a critical reflection on the development and implementation processes of climate change policies in Belo Horizonte and other cities, helping to build a better and stronger path to plan and put into action climate change initiatives at the local level.

7.2. Limitations and further research

The time-space constraint considerably limited this research, as the subject is so wide and the data needed are not available. Some people contacted did not agreed to participate in the research or did not sent their answer in time to be analyzed, and published here. However, the data gathered were exhausted in both discussion and analysis. A different organization of this study would be distributing the challenges under each axis of PREGEE over the analysis categories. However, the difficulty to access the sources and the time constraints precluded a deeper sectorial analysis. Given the complexity of the municipal governmental arrangements, the multidisciplinary

characteristic of the PREGEE and the plurality of actors, the research requires longer period of realization and field work.

A further deeper research could unfold of this study, more suitable for a PhD, for example, because there is a need to understand the limitations to implementing climate change policies at the city level, in order to advance combating climate change in a more sustainable and durable way. Some topics could be better investigated, for example research on the qualified power of members of CMMCE inside their own institutions would be interesting in order to understand how the decisions on the scope of PREGEE and CMMCE could be better implemented by these agencies. Or the analysis of the stakeholders outside the committee, that could provide a better understanding of the political scenario in the city. Also, investigating how the civil society could be better organized in order to lobby in favor of this agenda could also be fruitful. All in all, understanding the process of policy development and implementation at the local level in order to assure its effectiveness is extremely important for the future of the engagement of the cities combating climate change. It is important that cities could learn from each other's best practices and challenges. This topic is far from being exhausted in this study, this being just the beginning of researching on a topic that should be deeply investigated according different realities and backgrounds.

8. REFERENCES

BETSILL, M. M. & BULKELEY, H. 2006. Cities and the multilevel governance of global climate change. *Global Governance: A Review of Multilateralism and International Organizations,* 12**,** 141-159.

BHTRANS. 2016. *Sobre a BHTRANS* [Online]. Available: http://www.bhtrans.pbh.gov.br/portal/page/portal/portalpublico/Temas/BHTRANS/BHTRANS-2013 [Accessed 20 May 2016].

BIANCHI, R. & KOSSOUDJI, S. A. 2001. *Interest Groups and Organizations as Stakeholders,* Social Development Department, World Bank.

BRAZILIAN MINISTRY OF ENVIRONMENT 2016a. Plano Nacional de Adaptação à Mudança do Clima - Executive Summary.

BRAZILIAN MINISTRY OF ENVIRONMENT. 2016b. *Política Nacional sobre Mudança do Clima* [Online]. Available: http://www.mma.gov.br/clima/politica-nacional-sobre-mudanca-do-clima [Accessed 30 April 2016].

BRAZILIAN MINISTRY OF FOREIGN AFFAIRS. 2016. *Note 494 - Joint Statement by BASIC countries at the Press Conference on 8 December 2015, Paris* [Online]. Available: http://www.itamaraty.gov.br/pt-BR/notas-a-imprensa/12655-comunicado-conjunto-do-basic-por-ocasiao-da-conferencia-de-paris-paris-8-de-dezembro-de-2015 [Accessed 29 April 2016].

BRAZILIAN MINISTRY OF PLANNING. 2016. *PAC - Minas Gerais* [Online]. Available: http://www.pac.gov.br/estado/mg [Accessed 18 May 2016].

BRINKERHOFF, D. W. & CROSBY, B. 2002. *Managing policy reform: concepts and tools for decision-makers in developing and transitioning countries,* Kumarian Press BloomfieldCT.

BRUN, C. 2015. Qualitative Methods: an introduction (Class Slides).

BRUN, C., MAZURANA, D., JACOBSEN, K. & GALE, L. 2013. 'I love my soldier': developing responsible and ethically sound research strategies in a militarised society. *Research Methods in Conflict Settings: A View from Below***,** 129.

BRYMAN, A. 2016. *Social research methods*, Oxford university press.

BULKELEY, H. & BETSILL, M. 2005. Rethinking sustainable cities: multilevel governance and the 'urban' politics of climate change. *Environmental politics,* 14**,** 42-63.

CÂMARA MUNICIPAL DE BELO HORIZONTE. 2016a. *Atividade Legislativa - Comissões Permanentes* [Online]. Available: http://www.cmbh.mg.gov.br/leis/comissoes/permanentes [Accessed 20 May 2016].

CÂMARA MUNICIPAL DE BELO HORIZONTE. 2016b. *Entenda como funciona o processo legislativo* [Online]. Available: http://www.cmbh.mg.gov.br/leis/conheca-o-processo-legislativo/entenda-como-funciona-o-processo-legislativo [Accessed 20 May 2016].

CÂMARA MUNICIPAL DE BELO HORIZONTE. 2016c. *Plano Diretor* [Online]. Available: http://www.cmbh.mg.gov.br/atividade-legislativa/planejamento-orcamento-publico/plano_diretor [Accessed 20 May 2016].

CARVALHO, L. P. D. 2016. Interview guide and follow-up emails. *In:* REGGIANI, M. C. P. (ed.).

CEMIG 2011. CEMIG - 10 iniciativas para o clima - Compromisso da CEMIG com as mudanças climáticas.

CEMIG. 2016. *Who we are* [Online]. Available: http://www.cemig.com.br/en-us/the_cemig/about_us/Pages/default.aspx [Accessed 20 May 2016].

CITY COUNCIL REPRESENTATIVE 2016. Interview Guide. *In:* REGGIANI, M. C. P. (ed.).

CITY GOVERNMENT REPRESENTATIVE 1 2016a. Audio 1. *In:* REGGIANI, M. C. P. (ed.).

CITY GOVERNMENT REPRESENTATIVE 1 2016b. Audio 2. *In:* REGGIANI, M. C. P. (ed.).

CITY GOVERNMENT REPRESENTATIVE 2 2016a. Email. *In:* REGGIANI, M. C. P. (ed.).

CITY GOVERNMENT REPRESENTATIVE 2 2016b. Whatsapp Audios.

CITY GOVERNMENT REPRESENTATIVE 3 2016. Email. *In:* REGGIANI, M. C. P. (ed.).

CIVIL SOCIETY REPRESENTATIVE 1 2016. Interview Guide. *In:* REGGIANI, M. C. P. (ed.).

CIVIL SOCIETY REPRESENTATIVE 2 2016. Interview Guide. *In:* REGGIANI, M. C. P. (ed.).

COPASA. 2016. *Gestão Ambiental* [Online]. Available: http://www.copasa.com.br/wps/portal/internet/meio-ambiente/gestao-ambiental [Accessed 20 May 2016].

CRANG, M. & COOK, I. 2007. *Doing ethnographies,* London, Sage.

CREA-MG 2016a. Engenheiros assumem compromissos com metas ambientais da ONU.

CREA-MG. 2016b. *Quem somos* [Online]. Available: http://www.crea-mg.org.br/crea-minas/Pages/Quem-somos.aspx [Accessed 26 May 2016].

DOWLING, R. 2000. Power, subjectivity and ethics in qualitative research.

ENERGY SECTOR MANAGEMENT PROGRAM 2013. TRACE - Tool for Rapid Asssessment of City Energy - Helping Cities Realize Energy Efficiency Opportunities. *In:* WORLD BANK (ed.).

FEAM 2014a. Estratégia de Adaptação Regional às Mudanças Climáticas para Minas Gerais.

FEAM 2014b. Estudo de Vulnerabilidade Regional às Mudanças Climáticas.

FEAM 2015. Plano de Energia e Mudanças Climáticas de Minas Gerais - Sumário Executivo.

FEAM. 2016. *Energia e Mudanças Climáticas* [Online]. Available: http://www.feam.br/mudancas-climaticas [Accessed 10 May 2016].

FEDERATIVE REPUBLIC OF BRAZIL 1988. Constituição da República Federativa do Brasil de 1988.

FEDERATIVE REPUBLIC OF BRAZIL 1999. LEI No 9.790, DE 23 DE MARÇO DE 1999. *In:* DIÁRIO OFICIAL DA UNIÃO (ed.). Brazil.

FEDERATIVE REPUBLIC OF BRAZIL 2009. LEI Nº 12.187, DE 29 DE DEZEMBRO DE 2009. *In:* DIÁRIO OFICIAL DA UNIÃO (ed.). Brasilia.

FEDERATIVE REPUBLIC OF BRAZIL 2015. Intended Nationally Determined Contribution towards achieving the objective of the United Nations Framework Convention on Climate Change. UNFCCC.

FIEMG. 2016. *Gestão de Mudanças Climáticas* [Online]. Available: http://www7.fiemg.com.br/FIEMG/produto/gestao-de-mudancas-climaticas [Accessed 20 May 2016].

GEOFORT. 2016. *GeoCraft* [Online]. Available: http://geocraft.nl/english/ [Accessed 2 June 2016].

GRIGGS, D., STAFFORD-SMITH, M., GAFFNEY, O., ROCKSTRÖM, J., ÖHMAN, M. C., SHYAMSUNDAR, P., STEFFEN, W., GLASER, G., KANIE, N. & NOBLE, I. 2013. Policy: Sustainable development goals for people and planet. *Nature,* 495**,** 305-307.

IBGE. 2016a. *Cidades@ - Minas Gerais - Belo Horizonte* [Online]. Available: http://cidades.ibge.gov.br/xtras/perfil.php?codmun=310620 [Accessed 16 April 2016].

IBGE. 2016b. *Minas Gerais - Belo Horizonte - infográficos: frota municipal de veículos* [Online]. Available: http://cod.ibge.gov.br/X4E [Accessed 20 May 2016].

IBGE. 2016c. *Sinopse do Censo Demográfico de 2010 - Brasil* [Online]. Available: http://www.censo2010.ibge.gov.br/sinopse/index.php?dados=8 [Accessed 1 May 2016].

ICLEI. 2016a. *Sustainable City* [Online]. Available: http://www.iclei.org/activities/our-agendas/sustainable-city.html [Accessed 16 April 2016].

ICLEI. 2016b. *Urban LEDS* [Online]. Available: http://urbanleds.iclei.org/ [Accessed 10 February 2016].

INDUSTRY REPRESENTATIVE 1 2016. Interview Guide and follow-up emails. *In:* REGGIANI, M. C. P. (ed.).

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION 2014a. ISO 18091:2014 - Quality management systems -- Guidelines for the application of ISO 9001:2008 in local government.

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION 2014b. Sustainable development of communities - Indicators for city services and quality of life. *ISO 37120:2014.* ISO.

KATZ, C. 1994. Playing the field: questions of fieldwork in geography. *The Professional Geographer,* 46**,** 67-72.

KLERING, L. R., BERGUE, S. T., DA SILVA SCHRÖEDER, C., PORSSED, M. D. C. S., STRANZ, E. & KRUEL, A. J. 2011. Competências, papéis e funções dos poderes municipais no contexto da administração pública contemporânea. *Análise–Revista de Administração da PUCRS,* 22.

LACERDA, M. 2012. Programa de Governo - BH segue em frente - 2013-2016.

LEESON, P. F. & MINOGUE, M. 1988. *Perspectives on Development: Cross-disciplinary Themes in Development Studies*, Manchester University Press.

MAY, T. 2001. *Social research: Issues, methods and process,* Buckhingham, McGraw-Hill Education (UK).

MIDTTUN, A. 2009. Stakeholders on climate change. *North and South perspectives*.

NOSSA BH. 2016. *Quem somos nós* [Online]. Available: http://nossabh.org.br/ [Accessed 26 May 2016].

PEREIRA, E. M. D. 2016. *Curriculo Lattes* [Online]. Available: http://lattes.cnpq.br/4636671336311916 [Accessed 26 May 2016].

PREFEITURA MUNICIPAL DE BELO HORIZONTE 2011. DECRETO Nº 14.639, DE 10 DE NOVEMBRO DE 2011. *In:* DIÁRIO OFICIAL DO MUNICÍPIO (ed.). Belo Horizonte.

PREFEITURA MUNICIPAL DE BELO HORIZONTE 2013a. DECRETO Nº 15.317, DE 02 DE SETEMBRO DE 2013. *In:* DIÁRIO OFICIAL DO MUNICÍPIO (ed.). Belo Horizonte.

PREFEITURA MUNICIPAL DE BELO HORIZONTE 2013b. Relatório Técnico Final - Plano de Redução das Emissões de GEE. Belo Horizonte.

PREFEITURA MUNICIPAL DE BELO HORIZONTE 2014. Plano Plurianual de Ação Governamental - PPAG 2014-2017. *In:* SECRETARIA MUNICIPAL DE PLANEJAMENTO, O. E. I. (ed.). Belo Horizonte.

PREFEITURA MUNICIPAL DE BELO HORIZONTE 2015. Inventário de Emissões de Gases de Efeito Estufa - 2a atualização - 2011/2012/2013. Belo Horizonte.

PREFEITURA MUNICIPAL DE BELO HORIZONTE. 2016a. *Certificação em Sustentabilidade Ambiental de Empreendimentos de Belo Horizonte* [Online]. Available: http://cesa.pbh.gov.br/scsae/index.smma [Accessed 10 April 2016 2016].

PREFEITURA MUNICIPAL DE BELO HORIZONTE. 2016b. *Comitê Municipal sobre Mudanças Climáticas e Ecoeficiência - Membros Atuais* [Online]. Available: http://colegiados.pbh.gov.br/sgc/representantesColegiadosPortalPbh.php?c=61383 [Accessed 25 May 2016].

PREFEITURA MUNICIPAL DE BELO HORIZONTE. 2016c. *Contas Públicas - Orçamento Anuais* [Online]. Available: http://portalpbh.pbh.gov.br/pbh/ecp/comunidade.do?evento=portlet&pIdPlc=ecpTaxonomiaMenuPortal&app=contaspublicas&tax=11734&lang=pt_BR&pg=6420&taxp=0& [Accessed 27 May 2016].

PREFEITURA MUNICIPAL DE BELO HORIZONTE. 2016d. *Educação - Apresentação* [Online]. Available: http://portalpbh.pbh.gov.br/pbh/ecp/comunidade.do?evento=portlet&pIdPlc=ecpTaxonomiaMenuPortal&app=educacao&tax=7445&lang=pt_BR&pg=5564&taxp=0& [Accessed 20 May 2016].

PREFEITURA MUNICIPAL DE BELO HORIZONTE. 2016e. *Estatísticas e indicadores* [Online]. Available: http://portalpbh.pbh.gov.br/pbh/ecp/comunidade.do?app=estatisticaseindicadores [Accessed 18 May 2016].

PREFEITURA MUNICIPAL DE BELO HORIZONTE. 2016f. *Gestão Compartilhada, um modo de governar* [Online]. Available: http://gestaocompartilhada.pbh.gov.br/secretaria/apresentacao-secretaria [Accessed 20 May 2016].

PREFEITURA MUNICIPAL DE BELO HORIZONTE. 2016g. *Meio Ambiente - Apresentação* [Online]. Available: http://portalpbh.pbh.gov.br/pbh/ecp/comunidade.do?evento=portlet&pIdPlc=ecpTaxonomiaMenuPortal&app=meioambiente&tax=8192&lang=pt_BR&pg=5700&taxp=0& [Accessed 20 May 2016].

PREFEITURA MUNICIPAL DE BELO HORIZONTE. 2016h. *Meio Ambiente - CMMCE* [Online]. Available: http://portalpbh.pbh.gov.br/pbh/ecp/comunidade.do?evento=portlet&pIdPlc=ecpTaxonomiaMenuPortal&app=meioambiente&tax=16726&lang=pt_BR&pg=5700&taxp=0& [Accessed 16 April 2016].

PREFEITURA MUNICIPAL DE BELO HORIZONTE. 2016i. *Meio Ambiente - Projetos* [Online]. Available: http://portalpbh.pbh.gov.br/pbh/ecp/comunidade.do?evento=portlet&pIdPlc=ecpTaxonomiaMenuPortal&app=meioambiente&tax=16731&lang=pt_BR&pg=5700&taxp=0& [Accessed 11 May 2016].

PREFEITURA MUNICIPAL DE BELO HORIZONTE. 2016j. *Planejamento Urbano - Estrutura* [Online]. Available: http://portalpbh.pbh.gov.br/pbh/ecp/comunidade.do?evento=portlet&pIdPlc=ecpTaxonomiaMenu

Portal&app=planejamentourbano&tax=23283&lang=pt_br&pg=8843&taxp=0& [Accessed 20 May 2016].

PREFEITURA MUNICIPAL DE BELO HORIZONTE. 2016k. *Saúde - Estrutura* [Online]. Available: http://portalpbh.pbh.gov.br/pbh/ecp/comunidade.do?evento=portlet&pIdPlc=ecpTaxonomiaMenuPortal&app=saude&tax=7481&lang=pt_BR&pg=5571&taxp=0& [Accessed 20 May 2016].

PREFEITURA MUNICIPAL DE BELO HORIZONTE. 2016l. *Secretaria Municipal de Serviços Urbanos* [Online]. Available: http://portalpbh.pbh.gov.br/pbh/ecp/comunidade.do?app=servicosurbanos [Accessed 20 May 2016].

PREFEITURA MUNICIPAL DE BELO HORIZONTE. 2016m. *SLU - Apresentação* [Online]. Available: http://portalpbh.pbh.gov.br/pbh/ecp/comunidade.do?evento=portlet&pIdPlc=ecpTaxonomiaMenuPortal&app=slu&tax=7652&lang=pt_BR&pg=5600&taxp=0& [Accessed 20 May 2016].

PREFEITURA MUNICIPAL DE BELO HORIZONTE. 2016n. *SUDECAP - A autarquia* [Online]. Available: http://portalpbh.pbh.gov.br/pbh/ecp/comunidade.do?evento=portlet&pIdPlc=ecpTaxonomiaMenuPortal&app=sudecap&tax=7494&lang=pt_BR&pg=5581&taxp=0& [Accessed 20 May 2016].

PREFEITURA MUNICIPAL DE BELO HORIZONTE. 2016o. *URBEL* [Online]. Available: http://portalpbh.pbh.gov.br/pbh/ecp/comunidade.do?evento=portlet&pIdPlc=ecpTaxonomiaMenuPortal&app=urbel&tax=7490&lang=pt_BR&pg=5580&taxp=0& [Accessed 20 May 2016].

PREFEITURA MUNICIPAL DE BELO HORIZONTE. 2016p. *Visit BH - Practical Information* [Online]. Available: http://visitbh.pbh.gov.br/en/practical-information [Accessed 16 April 2016].

REI, F. & CUNHA, K. The Environmental Paradiplomacy In New International Governance. 1st World Sustain. Forum, 2011. MDPI.

ROSE, G. 1997. Situating knowledges: positionality, reflexivities and other tactics. *Progress in human geography,* 21**,** 305-320.

RUTH, M. 2006. *Smart growth and climate change: Regional development, infrastructure and adaptation*, Edward Elgar Publishing.

RYAN, D. 2014. Shaping local climate policies: A review of experience. Buenos Aires, Argentina: Fundación Ambiente y Recursos Naturales (FARN).

RYAN, D. 2015. From commitment to action: a literature review on climate policy implementation at city level. *Climatic Change*, 131**,** 519-529.

SANTOS, M. H. D. C. 1997. Governabilidade, Governança e Democracia: Criação de Capacidade Governativa e Relações Executivo-Legislativo no Brasil Pós-Constituinte. *Dados*, 40.

SEMAD. 2016. *Institucional* [Online]. Available: http://www.meioambiente.mg.gov.br/instituicao [Accessed 20 May 2016].

SINDUSCON-MG. 2016. *História* [Online]. Available: http://www.sinduscon-mg.org.br/index.php/institucional/historia/ [Accessed 20 May 2016].

SOARES, R. M. & RODRIGUES, D. 2010. Políticas Públicas de incentivo ao uso de sistemas de aquecimento solar no Brasil: acompanhamento das leis aprovadas e dos projetos de lei em tramitação. Cidades Solares.

SOUZA, V. M. D. 2014. *Que diferença faz lei ou decreto?* [Online]. JusBrasil. Available: http://drvaldinar.jusbrasil.com.br/artigos/116712721/que-diferenca-faz-lei-ou-decreto [Accessed 20 May 2016].

STATE GOVERNMENT REPRESENTATIVE 2016. Interview guide. *In:* REGGIANI, M. C. P. (ed.).

TAMPIERI, G. L. C. 2016. Audio. *In:* REGGIANI, M. C. P. (ed.).

UN HABITAT. 2016. *Climate Change* [Online]. Available: http://unhabitat.org/urban-themes/climate-change [Accessed 17 March 2016].

UNFCCC 2015. Adoption of the Paris Agreement.

UNFCCC. 2016a. *Kyoto Protocol* [Online]. Available: http://unfccc.int/kyoto_protocol/items/2830.php [Accessed 29 April 2016 2016].

UNFCCC. 2016b. *The Lima-Paris Action Agenda - Cooperative initiatives* [Online]. Available: http://climateaction.unfccc.int/ [Accessed 4 May 2016 2016].

UNITED NATIONS 1992. Rio Declaration on Environment and Development.

UNITED NATIONS. 2016. *Low Carbon Development* [Online]. Sustainable Development Knowledge Platform. Available: https://sustainabledevelopment.un.org/index.php?menu=1448 [Accessed 10 May 2016].

UNITED NATIONS DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS. 2015. *Sustainable Development Goals* [Online]. Available: https://sustainabledevelopment.un.org/topics [Accessed 22nd September 2015].

VAN STADEN, M. & MUSCO, F. 2010. *Local governments and climate change: sustainable energy planning and implementation in small and medium sized communities*, Springer Science & Business Media.

WORLD BANK 2000. *Cities in transition : World Bank urban and local government strategy*, Washington, D.C, World Bank.

WORLD BANK. 2016. *Stakeholder Analysis* [Online]. Available: http://www1.worldbank.org/publicsector/anticorrupt/PoliticalEconomy/stakeholderanalysis.htm [Accessed 18 April 2016].

WORLD COMISSION ON ENVIRONMENT AND DEVELOPMENT 1987. Our Common Future. *In:* BRUNDTLAND, G., KHALID, M., AGNELLI, S., AL-ATHEL, S., CHIDZERO, B., FADIKA, L., HAUFF, V., LANG, I., SHIJUN, M. & DE BOTERO, M. M. (eds.). UN World Commission on Environmental and Development.

WORLD COUNCIL ON CITY DATA. 2016. *Data for Cities* [Online]. Available: http://open.dataforcities.org/ [Accessed 28 May 2016].

WORLD RESOURCES INSTITUTE. 2016. *What is an INDC?* [Online]. Available: http://www.wri.org/indc-definition [Accessed 30 April 2016].

ANNEX I – Analysis of PREGEE proposals

Table 4 - PREGEE proposals and related programs and indicators

PREGEE AXIS AND GUIDELINE	PREGEE PROPOSALS	PPAG PROGRAM (*SUSTAINER PROJECTS)	INITIAL TOTAL PLANNED BUDGET TO THE PPAG PROGRAM – BRL (BILLION)	PPAG INDICATORS	RELATED ISO 37120 INDICATOR[1]	COMMENTS
TRANSPORTATION – IMPROVEMENT OF PUBLIC TRANSPORTATION INFRASTRUCTURE	1. Implantation of Consorted Urban Operations[2]	060	276,5	No indicators	-	The program on Management of Urban Mobility do not have defined proposals and indicators.
	2. Implantation of lines of metropolitan urban trains	062	138,7	No indicators	18.1; 18.3	The program on Management of Municipal Road System do not have defined proposals and indicators.
	3. Expansion of metropolitan railway system (all 5 lines forecasted on PDDI of BH's metropolitan region)	208*	210,1	Km expanded	18.1; 18.3	Despite foreseen in both PPAG and PREGEE, this proposal was not put into action yet, because it depends on federal and state budget to be fulfilled. The initial budget was just an estimation, but the resources from PAC program were never consolidated.
	4. Elaboration of Value Engineering Studies for the big investments in mobility	-	-	-	-	Despite with no direct program or indicator to this proposal, the program 060 is about the better management of urban mobility, the Value Engineering Studies could be included here.
TRANSPORTATION – SUBSIDIZED PUBLIC TRANSPORT SYSTEM	5. Subsidized tariffs in public transport system	-	-	-	18.3	Despite not foreseen as an indicator at PPAG, its result would fit program 211 – priority to public transportation.
	6. Reduction of quantity and increase in rates for paid public	-	-	-	18.4	This action contradicts the program 245, in which wants to increase the number of underground parking in the city center through concession to private companies.

	parking for light vehicles in saturated areas					
	7. Increase of restrictions to permit releases or surcharge for private parking businesses in saturated areas	-	-	-	18.4	This action contradicts the program 245, in which wants to increase the number of underground parking in the city center through concession to private companies.
	8. Institution of toll for light vehicles in saturated areas and time	-	-	-	18.4	Despite not foreseen as an indicator at PPAG, its result would fit program 211 – priority to public transportation.
	9. Institution of driving restriction days according to license plate number in saturated areas and time	-	-	-	18.4	Despite not foreseen as an indicator at PPAG, its result would fit program 211 – priority to public transportation.
TRANSPORTATION – PROMOTE THE TECHNOLOGICAL UPDATE OF THE ROLLING FLEET IN THE CITY	10. Regulation of Green Seal for low-emission vehicles	-	-	-	8.1; 8.2; 8.3; 8.4; 8.5	There are no programs in the PPAG that could fit these proposals for low-emission vehicles regulation. Program 245* is about Safe and Sustainable Transportation and only provides actions and indicators related to deaths on traffic, bike lanes, underground parking and Mobicentro project[3].
	11. Formulate incentive proposals (or exemption) of low-emission vehicles and fuels, and renewal of the fleet	-	-	-	8.1; 8.2; 8.3; 8.4; 8.5	
	12. Restriction of rolling of high-emission vehicles in saturated areas	-	-	-	8.1; 8.2; 8.3; 8.4; 8.5	
	13. Implantation of Vehicle Fleet Inspection, in a	-	-	-	8.1; 8.2; 8.3; 8.4; 8.5	

	way to guarantee to meet the regulated emissions' limits					
	14. Include vehicles of less environmental impact in the public transport system, taxi and school transportation	-	-	-	8.1; 8.2; 8.3; 8.4; 8.5	
	15. Include vehicles of less environmental impact in the public power rolling fleet	-	-	-	8.1; 8.2; 8.3; 8.4; 8.5	
TRANSPORTATION – MEASURES PLANNED AT PLANMOB – FULL INVESTMENT SCENARIO UP TO 2020	16. Implantation of BRT in Avenidas Antonio Carlos, Cristiano Machado e Pedro II	062, 211*	288,7	Number of implanted lanes	18.2; 18.3	The program on Management of Municipal Road System do not have defined proposals and indicators.
	17. Increase the number of exclusive bus lanes	062, 211*	288,7	Km of interventions to prioritize public transport system	18.2; 18.3	The program on Management of Municipal Road System do not have defined proposals and indicators.
	18. Increase the number of selective bus lines (vehicles with air conditioning and wherein all passengers travel seated)	211*	150,02	Number of executive lines implemented	18.2; 18.3	The targeted increase on the number of executive lines is from 2 to 5 lines. Considering the size and population density in Belo Horizonte, this number is far from being effective.
	19. Implantation of real time	212*	20,66	Number of electronic	18.2; 18.3	

	information system about bus traffic			information panels		
	20. Implantation of city rail lines 1,2 and 3	208*	210,1	Km of city rail lines expanded	18.2; 18.3	Despite foreseen in both PPAG and PREGEE, this proposal was not put into action yet, because it depends on federal and state budget to be fulfilled. The initial budget was just an estimation, but the resources from PAC program were never consolidated.
	21. Forecasted interventions on VIURBS[4]	209*	333,02	Number of implanted connection lanes between neighborhoods	18.2; 18.3	
	22. Implantation of 360km of bike lanes	245*	10,65	Km of bike lanes	18.6; 18.8	PPAG targeted to increase from 43 to 200 km up to 2016.
	23. Implantation of public bikes system (rent/loan of bikes in strategic areas)	-	-	-	18.6; 18.8	The initiative started to be implanted with the cooperation of a private sponsor.
	24. Implantation of walk pathway network	245*; 233*	161,1	23 interventions under Mobicentro project; m^2 of restored pathways	18.8	Together with the Mobicentro project, the city maintenance project will promote the revitalization of pathways in the city. However, there are no isolated actions to promote the increase on length of pathways itself on PPAG.
	25. Physical and tariff integration of public transport system	-	-		18.3	This is a critic proposal once there are several conflicts of interest within the government, the public transportation companies and the final consumer. Currently, an NGO, Tarifa Zero, has been fighting for a free public transport system.
ENERGY	26. Promote the revision of Bill regarding solar power in urban	-	-	-	7.4	The citizens have already started to voluntarily adhere to solar power for water heating in residential and commercial buildings. However, not having the issue addressed in the PPAG

	buildings (PL. 1.390/07) within CMMCE – WG Energy					indicates the government does not classify it as a structural measure to the long-term sustainable development of the city.
27.	Establish targets of enlargement for the Program Sustainable Seal BH	243*	582,31	-	7.3; 7.4	Not having any indicators to measure and follow the enlargement process is a weakness in terms of PPAG.
28.	Review procedures within municipal licensing to promote the use of clean energy, low polluting potential and urban regularization	-	-	-	7.4	
29.	Bring to PREGEE the reducing targets on power consumption proposed by program on the regional power distribution company, narrowing the contact between CEMIG and PBH according to PLAMGE	-	-	-	7.1; 7.3; 7.5	Since CEMIG is the state power distribution company, the municipality does not have focused projects on local power supply.
30.	Incentive the substitution of high GHG fuels for renewables and promote cleaner energy	-	-	-	7.4	Not having the issue addressed in the PPAG indicates the government does not classify it as a structural measure to the long-term sustainable development of the city.

	services to large consumers					
	31. Tax exemption to companies providing services involving renewable energy	-	-	-	7.4	Not addressing the issue of tax incentives or any matter of carbon taxation in the PPAG indicates the government does not classify it as a structural measure to the long-term sustainable development of the city.
SANITATION AND WASTE	32. Establishment of targets to increase selective waste collection (recyclables)	228*	90,49	Number of neighborhoods served; Number of LEV (voluntary sites of delivery)	16.1; 16.2; 16.3; 21.3	This is a problematic area, once up to 2015, there was an increase of only 4 neighborhoods served by the service, when the target was to increase 30 by 2016. Also the number and distribution of LEV are points of disagreement between the population and SLU.
	33. Establishment of targets to increase the treatment of organic waste	228*	90,49	Elaboration of Municipal Plan on Integrated Management of Waste	20.2; 20.3; 20.4; 20.5; 21.3	The Plan supposed to be elaborated up to 2014. However, until the date of this study publication, the Plan was not released.
	34. Implantation of biogas use system at CTR Macaúbas (landfill)	-	-	-	8.3; 16.4	This actions depends on several governmental bodies and companies to be put into action.
	35. Implantation of biogas use system at ETE Onça (sewage treatment station)	243*	582,31	Percentage of population served with treated sewage system	8.3; 20.2; 20.3; 20.4; 20.5	This action depends on COPASA engagement.
	36. Incentive the reduction of urban solid waste generation	228*; 243*	672,8	Elaboration of Municipal Plan on Integrated Management of Waste; Elaboration and	16.2; 16.3; 16.4; 16.5; 16.6; 16.7; 16.8; 21.3	The waste plan, has a project of communication and mobilization of the civil society. It supposed to be elaborated up to 2014. However, until the date of this study publication, the waste plan was not released. One of the bottleneck of sustainable development is the civil society engagement to the issue, education plans are usually effective

				implementation Environmental Education in municipal schools		in the long-term, while promoting the shift on daily habits and mindset.
	37. Adoption of technologies of urban solid waste treatment that do not emit GHG to reduce the demand for landfills	228*	90,49	Elaboration of Municipal Plan on Integrated Management of Waste	8.3; 16.4	The Plan supposed to be elaborated up to 2014. However, until the date of this study publication, the plan was not released.

Source: Based on International Organization for Standardization (2014b); Prefeitura Municipal de Belo Horizonte (2013b); Prefeitura Municipal de Belo Horizonte (2014)

[1] The related ISO 37120 indicators are indicators that can be directly affected by the proposal. Therefore, a measure of the effectiveness of this proposal/project.

[2] Consorted Urban Operations are measures and interventions coordinated by the municipal government with the participation of owners, residents, permanent users and private investors with the goal to promote structural urban changes, social improvement and environmental enhancement in an area.

[3] Mobicentro project is the set of road works in the hyper center to guarantee and prioritize pedestrians and public transport, emphasizing safety and smooth flow of traffic and dispersion of individual vehicles in the center.

[4] VIURBS is the Road Structure Program of Belo Horizonte

ANNEX II – Stakeholders Reference Matrix

Table 5 - Stakeholders Reference Matrix

GROUP OF STAKEHOLDERS	STAKEHOLDER	THE INTEREST ON LOW-CARBON POLICIES	THE LEVEL OF INFLUENCE (POWER OF IMPLEMENTING THE POLICY)	*EFFECTIVE POWER*	PERCEIVED CHALLENGES FOR PREGEE IMPLEMENTATION	COMMENTS
CITY GOVERNMENT AGENCIES	SMMA, BHTRANS, SLU, SUDECAP	High	High implementation power. High decision power at the committee	Promoters	- Organizational and financial challenges - Absence of communication plan - Lack of technology and sectorial knowledge - The conflict of interests regarding the economic sphere is something considerable. For example, there are some decisions that are likely to harm the business, and generate some reactions and negotiations contrary to what was decided (e.g. the recent adoption of BRT that is trying to be reverted by some pressure groups/influential individuals)	The lack of power to implement the decisions distances some secretariats (defenders) of the theme, being difficult to translate climate change to proposals/actions that would involve them. The lack of understanding inside the City Council is something that worries. Within the city council representatives at CMMCE, the interest to promote the climate change agenda is high, but that is not necessarily true for the majority of counselors, being difficult to institutionalize matters related to climate change by the legislative. Regarding the promoters, the challenge is to overcome the implementation problems inside their agencies (financial, structural). Some of the stakeholders are in the borderline to be apathetics, therefore a reform on the committee composition is needed, together with an internal communication plan to promote climate change within the governmental agencies.
	City Council	Medium to low	High implementation power. High decision power at the committee	Latents		
	SMSA, SMED, SMSU, SMAPU, SMAGC, URBEL	Medium	Low implementation power, high decision power at the committee (Medium to High)	Defenders		

STATE GOVERNMENT ENTITIES	SEMAD; COPASA-MG; CEMIG.	Medium to high	High implementation power, high decision power at the committee	Soft-Promoters	No comments on this matter	The state government entities have the role of guide and assist the decisions within the committee. CEMIG and COPASA are key agents to implement some actions regarding energy efficiency and sewage treatment. Giving their maturity to provide services considering the environmental sustainability, they do not have major challenges to overcome on the implementation phase. Since they do not have major interest on mitigate climate change only in Belo Horizonte, but high implementation power of some actions, they were considered soft-promoters.
CIVIL SOCIETY REPRESENTATIVES	SINDUSCON-MG (Building Industry Representative); CREA-MG (Building Industry Representative); FIEMG (Industry Representative); UNA (University); UFMG (University); PontoTerra (NGO); Nossa BH (NGO).	High	Low implementation power, high decision power at the committee (Medium to High)	Defenders	- Lack of diffusion of correct information to the society about climate change effects - The voluntary nature of the participation in the committee and lack of time to dedicate to the activities, incurring in the increase of the time of decision making process. - Lack of information regarding the committee and its work to the civil society - Divergence between the environmental interests and the lack of enforcement mechanisms provided by law - Lack of specific legal framework - Economic interests are preferred over the effective	Despite the civil society has relatively high power in the context of CMMCE, where PREGEE is planned and decided, their power to implement the actions is relatively low, thus the *defenders* position. That is because the voluntary actions of the civil society for mitigating climate change are still embryonic. The problems related to the local framing are still big and the information gap regarding climate change effects to their daily lives still needs to be filled. One example of voluntary actions when the society recognize the advantages of the environmental action was given by our informant Luciana. There is an increase in the use of

		structural actions to mitigate climate change - Climate change being treated only as a political discourse and not having effectively structural actions implanted - There are few initiatives that can converge with the reality of the industry in Belo Horizonte - Difficulty to assimilate climate change to the industry reality in Belo Horizonte - Limitation to target only the municipality area on the actions proposed, not integrating with the metropolitan area	solar power to heat water in Belo Horizonte despite there is no legal framework to regulate and enforce this use, but the society saw an economic and environmental advantage in this technology. Other point is that the committee is very representative in terms of different stakeholders, but it is not very known outside its realm. There is a need to improve this communication channel with the society, so the citizens can be aware of the problem, the urgency on combating it and the tools they have available. It is known the transformative power of society, pressuring for changes, which can be an important driver to sustainable development, but this pressure is only made when there is information.

Source: Own formulation based on interviews

.

ANNEX III – ISO 37120 AND PPAG

Table 6 - City services and quality of life indicators – ISO 37120

CLUSTER AREA	Core Indicator	Supporting Indicator
5. Economy	5.1. City's unemployment rate 5.2. Commercial/Industrial Assessment as a percentage of total assessment 5.3. Percentage of city population living in poverty	5.4. Percentage of persons in full-time employment 5.5. Youth unemployment rate 5.6. Number of businesses per 100 000 population 5.7. Number of new patents per 100 000 population per year
6. Education	6.1. Percentage of female school-aged population enrolled in school 6.2. Percentage of students completing primary education 6.3. Percentage of students completing secondary education 6.4. Student/teacher ratio	6.5. Percentage of male school-aged population enrolled in school 6.6. Percentage of school-aged population enrolled in school 6.7. Number of higher education degrees per 100 000 population
7. Energy	7.1. Total residential electrical use per capita (kilowatt/year) 7.2. Percentage of city population with authorized electrical service 7.3. Energy consumption of public buildings as a percentage of total consumption in the city 7.4. Percentage of total energy derived from renewable sources, as a share of the city's total energy consumption	7.5. Total electrical use per capita (kilowatt/year) 7.6. Average number of electrical interruptions per customer per year 7.7. Average length of electrical interruptions (in hours)
8. Environment	8.1. Fine particulate matter (PM2.5) concentration 8.2. Particulate Matter (PM10) concentration 8.3. Greenhouse gas emissions measured in tons per capita	8.4. NO^2 (nitrogen dioxide) concentration 8.5. SO^2 (Sulphur dioxide) concentration 8.6. O^3 (ozone concentration 8.7. Noise pollution 8.8. Percentage change in number of native species
9. Finance	9.1. Debt service ratio (debt service expenditure as a percent of a municipality's own-source revenue)	9.2. Capital spending as a percentage of total expenditures 9.3. Own-source revenue as a percentage of total revenues 9.4. Tax collected as percentage of tax billed
10. Fire and emergency response	10.1. Number of firefighters per 100 000 population 10.2. Number of fire related deaths per 100 000 population 10.3. Number of natural disaster-related deaths per 100 000 population	10.4. Number of volunteer and part-time firefighters per 100 000 population 10.5. Response time for emergency response services from initial call 10.6. Response time for fire department from initial call
11. Governance	11.1. Voter participation in last municipal election (as a percentage of eligible voters) 11.2. Women as a percentage of total elected to city-level office	11.3. Percentage of women employed in the city government workforce 11.4. Number of convictions for corruption/bribery by city officials per 100 000 population

		11.5. Citizens' representation: number of local officials elected to office per 100 000 population 11.6. Number of registered voters as a percentage of the voting age population
12. Health	12.1. Average life expectancy 12.2. Number of in-patient hospital beds per 100 000 population 12.3. Number of physicians per 100 000 population 12.4. Under age five mortality per 1 000 live births	12.5. Number of nursing and midwifery personnel per 100 000 population 12.6. Number of mental health practitioners per 100 000 population 12.7. Suicide rate per 100 000 population
13. Recreation		13.1. Square meters of public indoor recreation space per capita 13.2. Square meters of public outdoor recreation space per capita
14. Safety	14.1. Number of police officers per 100 000 population 14.2. Number of homicides per 100 000 population	14.3. Crimes against property per 100 000 14.4. Response time for police department from initial call 14.5. Violent crime rate per 100 000 population
15. Shelter	15.1. Percentage of city population living in slums	15.2. Number of homeless per 100 000 population 15.3. Percentage of households that exist without registered legal titles
16. Solid Waste	16.1. Percentage of city population with regular solid waste collection (residential) 16.2. Total collected municipal solid waste per capita 16.3. Percentage of the city's solid waste that is recycled	16.4. Percentage of the city's solid waste that is disposed of in a sanitary landfill 16.5. Percentage of the city's solid waste that is disposed of in an incinerator 16.6. Percentage of the city's solid waste that is burned openly 16.7. Percentage of the city's solid waste that is disposed of in an open dump 16.8. Percentage of the city's solid waste that is disposed of by other means 16.9. Hazardous waste generation per capita (tons) 16.10. Percentage of the city's hazardous waste that is recycled
17. Telecommunication and innovation	17.1. Number of internet connections per 100 000 population 17.2. Number of cell phone connections per 100 000 population	17.3. Number of landline phone connections per 100 000 population
18. Transportation	18.1. Kilometers of high capacity public transport system per 100 000 population 18.2. Kilometers of light passenger public transport system per 100 000 population 18.3. Annual number of public transport trips per capita 18.4. Number of personal automobiles per capita	18.5. Percentage of commuters using a travel mode to work other than a personal vehicle 18.6. Number of two-wheel motorized vehicles per capita 18.7. Kilometers of bicycle paths and lanes per 100 000 population 18.8. Transportation fatalities per 100 000 population 18.9. Commercial air connectivity (number of non-stop commercial air destinations)

19. Urban planning	19.1. Green area (hectares) per 100 000 population	19.2. Annual number of trees planted per 100 000 population 19.3. Areal size of informal settlements as a percentage of city area 19.4. Jobs/housing ration
20. Wastewater	20.1. Percentage of city population served by wastewater collection 20.2. Percentage of the city's wastewater that has received no treatment 20.3. Percentage of the city's wastewater receiving primary treatment 20.4. Percentage of the city's wastewater receiving secondary treatment 20.5. Percentage of the city's wastewater receiving tertiary treatment	
21. Water and Sanitation	21.1. Percentage of city population with potable water supply service 21.2. Percentage of city population with sustainable access to an improved water source 21.3. Percentage of population with access to improved sanitation 21.4. Total domestic water consumption per capita	21.5. Total water consumption per capita 21.6. Average annual hours of water service interruptions per household 21.7. Percentage of water loss (unaccounted for water)

Source: International Organization for Standardization (2014b)

Table 7 - PPAG Analyzed Resulting Areas

Resulting Area	Sustainer Projects	Other Projects and Proposals
Mobility City	208 - City Rail Expansion 209 - Implementation of the Cut Path 210 - Duplication Completion of Pedro I Avenue 211 - Priority to Public Transport 212 - Smart Mobility Management 245 - Safe and Sustainable Transport	060 - Urban Mobility Management 062 - Management of Municipal Road System
Sustainable City	228 - Collection, Treatment and Disposal of Solid Waste 230 – Urban Planning and Structuring 231 - Parks and Green Areas 232 - Movement Respect for BH 233 - City Maintenance 243 - Environmental Management 244 - Pampulha Viva	46 - Operation and Modernization of Public Cleaning 57 - Urban Policy Management 59 - Control of Urban Management 66 - Sanitation and Treatment Valley Funds 69 - Environmental Policy Management 72 - Planning, Monitoring and Management of Parks and Necropolis 73 - Preservation and Conservation of Fauna and Flora 159 - Squares and Gardens Management

Source: Prefeitura de Belo Horizonte (2014)

ANNEX IV – Summary of the methodological framework

Table 8 - Methodology and operationalization of variables

ANALYSIS DIMENSION	ANALYSIS CATEGORY	ANALYSIS UNITY	INDICATORS
LOCAL GOVERNMENT CAPACITY	- Legal capacity - Financial and organizational resources	- Municipal legal framework - PREGEE structure and governance - Governance structure for climate change in Belo Horizonte	- Existence of laws institutionalizing the PREGEE and its proposals - Existence of federal and/or municipal budget for implementing PREGEE - Existence of qualified personal within the governmental agencies and executive power ahead of main PREGEE axes and/or specialized departments
LOCAL FRAMING	- Society can relate climate change with local problems - Society can perceive the capacity of the climate mitigation action to generate socio-economic or environmental welfare	- Educational and awareness campaigns - Municipal school syllabus - Voluntary action for mitigating climate change	- Existence of campaigns made by or supported by the government to raise awareness to climate change and the need for sustainable development - Coordinated education campaigns in municipal schools (SMED action) - Existence of voluntary initiatives to mitigate climate change (such as heating systems based on solar power, etc.)
POLITICAL ACTORS AND FACTORS	- Political entrepreneur - Influence of interest groups (stakeholder analysis) - Role of political parties	- Government Plan of Márcio Lacerda and presence in international forums about climate change - CMMCE Stakeholders - City Council members on CMMCE and their participation	- Interest of dealing with climate change at all levels (municipal, state, national and international) - Perception of power relations within the committee - Counselors projects at City Council

Source: Own elaboration based on Ryan (2015).

ANNEX V - Preliminary Interview Guide

1) What is your position in relation to climate change? What is the relevance of the issue for civil society?

2) As the importance of climate change is disseminated to civil society and the role of [ORGANIZATION] in this regard?

3) As a representative of civil society in CMMCE as you realize that public opinion and the need of the population in general is seen and treated within the committee? [Question directed only to civil society representatives]

4) As holder of CMMCE member you have access to the development of procedures and monitoring PREGEE. Do you believe that PREGEE is a comprehensive plan in relation to the cross-sectional areas to climate change mitigation?

5) If yes, explain how it was / is their participation in the committee to decide on what actions to be implemented on the PREGEE.

6) Can you talk a little about how it is to be a member of CMMCE? How is the relationship between the members? There are more convergences of ideas or differences?

7) Do you believe that the views on the civil society are heard and respected in the same way as with other representatives? On a scale from 1 to 5 (1 being very poor and 5 being very strong) what would your perception of influence [ORGANIZATION], represented by you, have the CMMCE?

8) What are the perceived challenges of implementation of PREGEE actions?

9) What measures could be taken to remedy or mitigate these challenges in the near future so that PREGEE measures are universally implemented, reaching emissions reduction target? [Question only directed to city government representatives]