GRACIAS A LA NACIONALIZACIÓN DE LOS HIDROCARBUROS: A CRITICAL ANALYSIS OF BOLIVIA’S TRANSITION TO COMPRESSED NATURAL GAS


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This paper critically analyzes the implementation of compressed natural gas and the ways in which it creates discourse in urban Bolivia. The rapidly developing nation is keen on making ubiquitous use of compressed natural gas a reality by issuing subsidies, citing increased mobility, savings, and environmental stewardship as the primary motives. Currently, eight out of every 10 public vehicles in Bolivia are powered by compressed natural gas. Through semi-structured interviews, questionnaires and secondary data collection, this paper elucidates the transitional process of building a natural gas-based transport network through discursive governance. This work draws on the critical discourse analysis literature to dissect disaggregated modal preference data, government documents, and news articles collected in Santa Cruz, Latin America’s second fastest growing city. Moreover, this paper identifies and examines the ways in which the counter-discourse impacts the transformation of the country’s energy matrix. Results show that Bolivian automobile owners are reluctant to convert their automobiles, despite reduced transportation costs, stating that minimal compressed natural gas infrastructure exists outside of urban areas, and the conversion damages their vehicles’ motor. Additionally, the research reveals that automobile owners are currently the main beneficiaries, though respondents who do not possess an automobile speak more favorably of natural gas. Finally, this research illustrates that the compressed natural gas-oriented policies encourage personal automobile use that continues to drive socio-spatial segregation of Santa Cruz’s residents. Thus, the
compressed natural gas discourse helps shape the urban landscape by persuading the public to consume domestically extracted and manufactured natural gas.
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CHAPTER 1
INTRODUCTION

Problem Statement

Natural gas is currently the fastest growing sector in transportation and will overtake oil as the dominant fuel source in the Organization for Economic Co-Operation and Development (OECD) counties by 2031 (BP Energy Outlook 2035, 2014). For some countries, this ‘golden age of gas’ (Chazan, 2014) means that they have secured a short-term solution to increasing energy concerns. And with the proliferation of unconventional reserves, natural gas could be a long-term energy supply. For non-OECD countries, natural gas will account for 80% of the total increase in natural gas consumption from 2010 to 2035 (BP Energy Outlook 2035, 2014). Bolivia, a non-OECD country, recently discovered natural gas reserves are an opportunity to focus on domestic consumption and represent a way out of poverty. But, Bolivia has a contentious history with the extraction and production of the natural resource.

After discovering natural gas, the Bolivian government, under President Sánchez de Lozada, initiated a series of actions to attract multinational gas development and pursue the resource’s exportation (Perreault, 2008). However, the exportation of natural gas created tension between some Bolivians and the government, resulting in a series of violent conflicts during the early 2000s (Perreault and Valdivia, 2010). Conflicts over the exportation of natural gas continued, leading to the eventual election of President Evo Morales in 2005. In 2006, Morales nationalized the country’s natural gas fields and took full control of
the chief Bolivian gas company Yacimientos Petrolíferos Fiscales Bolivianos, aiming to redistribute wealth and alleviate poverty (Perreault, 2008). Since Morales’s election, Bolivia has amplified its natural gas production and consumption.

Bolivia is first in the production of natural gas in Latin America (CIA.gov, 2014) and is projected to have the fastest growing economy in the region during 2014 (Lazcano, 2014). Moreover, Bolivia’s natural gas consumption has increased by 54% since Morales nationalized the resource in 2006 (U.S. Energy Information Administration, 2014). A significant portion of this growth is due to the rising use of compressed natural gas (CNG). Approximately 30% of all vehicles in the country are powered by CNG, including 80% of Bolivia’s public transport fleet (Erbol, 2014). Under the direction of Morales, the Entidad Ejecutora de Conversión a Gas Natural Vehicular (EEC-GNV, Executing Entity for the Conversion to Vehicular Natural Gas) plans to transform the country’s transport energy matrix to CNG (EECGNV.gob.bo, 2014). Implementing this transformation will create profound changes, particularly in urban areas where demand is greatest. The history of resource extraction and development in Latin America is at the heart of the dependency theory.

Dependistas posit that the development of capitalism at the global scale created the underdevelopment of Latin America (Dietz, 1980). The “development of underdevelopment,” an argument put forth by Andre Gunder Frank, states that the rise of global capitalism produces development in the core nations while causing underdevelopment in the peripheral nations (Dietz, 1980). In other
words, the removal of surplus from the periphery generates development for the developed countries, leaving nothing for the periphery. Fernando Henrique Cardoso introduced the concept of “associated dependent development,” which counters Frank’s position by saying that development is possible in the periphery despite the core’s continued extraction of surplus (Dietz, 1980). The latter view is becoming evident in Bolivia, as President Morales has focused his attention on the domestic use of CNG.

This thesis critically examines the discourse surrounding Bolivia’s evolution from conventional gasoline and diesel to CNG as the primary fuel source. By drawing on the contemporary research pertaining to the critical discourse studies, development of transportation systems in Latin American, and finally, multifaceted implementation of urban transport governance, I argue that Bolivia’s CNG transition targets middle-class development and reproduces socio-spatial division in Santa Cruz, the country’s largest and Latin America’s second fastest growing city. As a result, the current CNG policies subsidize the cost of living for the already economically advantaged and produce an urban transport network that favors the personal automobile.

Purpose of the Study

Both transport policies and alternative fuels affect the urban environment. For example, alternative fuels impact transport, everyday mobility, and the continual development of urban space (Macmillen and Stead, 2014). Although, CNG governance is designed to redistribute wealth and generate a more equitable society, the rise in private automobile ownership occurs. By elucidating
Santa Cruz’s governance initiatives, this study provides an insight into the future of developing transport networks.

By shedding light on a developing nation and region that is experiencing vast socioeconomic growth, the case of Santa Cruz shows how there are more private vehicles on the roadways (Datos.ine.gob.bo, 2014) competing with a largely unregulated public transit system (Salek, 2010). Together with the CNG transition, rapid urbanization, and the measures to increase equality, Santa Cruz is a prime location to help researchers understand how top-down policies and their related discourse manifest in urban space. These urban processes influenced the design of this research and inform my overall research question: how does discourse play a role in Santa Cruz’s CNG transition?

Research Questions

Three ancillary questions direct my research: 1) what is the CNG discourse produced by the Bolivian state? 2) What is the counter-discourse created by the residents of Santa Cruz? And 3) what is the dialectical relationship between the discourse and counter-discourse? The following section is a brief introduction to the mixed-methods approach that I used in this study.

Research Methods

The initial step involved the categorization of the multiple types of transportation in Santa Cruz. The three transportation categories were predominantly private, mixed public and private, and predominantly public. Similar to Kirshner (2013), I incorporated data from the Programa de Alivio de Pobreza (2006 p. 26), which categorized the poverty level of the city’s 12
planned districts. This categorization method provided a basis for the types of transportation used throughout the city. I then selected three of the 12 districts to correspond to the predominantly private, mixed public and private, and predominantly public transportation groups. To survey the selected districts, I randomly selected *unidades vecinales* (UVs), or municipally defined neighborhoods.

The University of North Texas Office of Research Integrity and Compliance approved my Human Subjects Application Number 14164 on 28 April, 2014 (Appendices 1-5). The survey took place during a three-week field excursion in May 2014 and consisted of questionnaires, semi-structured interviews, focus groups, photographic data, and interviews with key informants. Moreover, I collected secondary data in the form of government documents and newspaper articles from May 2013 to December 2014. I performed a critical discourse analysis of the text (see Fairclough, 2000, 2005, 2013) and coded the prevailing themes. To analyze the results from the surveys and interviews, I also borrowed from Foucault’s idea of discourse. Foucault (1972) explains that discourse is the fusing between words and things to create a single system. Chapter three provides a detailed research methodology.

Limitations

Though I designed this study to understand the social and geographical implications of the CNG transition in Santa Cruz, Bolivia, there were some restrictions. First, due to time and budgetary constraints, I was not able to sample a significant number of the population. As a result, this study can only suggest
how the residents of Santa Cruz perceive the current transition to CNG. Second, many of the prospective key informants that I attempted to contact did not return phone calls and emails, which hindered my ability to completely integrate the Bolivian government’s perspective into this study.

Third, the stratification of the transport groups did not necessarily cover all the socioeconomic levels within the city’s districts. By using the Santa Cruz Poverty Relief Program (2006 p. 26) data, I accepted that I would encounter some residents who did not fit into one of the three transportation categories in which I placed them. Fourth, while conducting the semi-structured interviews, I could have internalized the discourse, introducing my own bias. During the interviews, I was careful not to use specific prompts that the participants could have potentially used to answer. Finally, some of the participants did not fully understand some of the interview and questionnaire questions, which possibly caused some confusion. The misunderstanding perhaps swayed some of the participants’ answers or triggered them to not answer a question.

Summary

CNG is a foundational component of Bolivia’s energy plan. This, however, has not always been the case. Historically, Bolivians have struggled to benefit internally from natural gas extraction. Previous administrations exported the natural resource to other countries, with few benefits funneling down to the Bolivian people (Perreault, 2008). The nationalization of natural gas may have enacted a new era in Bolivian governance. By collecting qualitative and quantitative data on Bolivia’s CNG transition my thesis suggests that the CNG
transition has produced a discourse that aims to benefit a select group and consequently reproduces Santa Cruz’s socio-spatial inequalities.
CHAPTER 2
RELATED LITERATURE

Introduction

More than half of the world’s population now resides in urban areas (United Nations, 2014). The influx of urban dwellers has significant implications on urban processes and alters the way in which municipalities create public policies. Recent studies reveal that both local and regional government entities play a pivotal role in the mobility and accessibility of urban residents (Camarero and Oliva, 2008; Preston and Rajé, 2007; Rau and Vega, 2014). This role is even more pronounced in the Global South, where government agencies generally do not express strict regulations on transport-related development.

Other studies show that growing urban populations are straining transportation systems, and governance is a primary mechanism to address transportation issues (Goyal, 2008). More importantly, transport geographers highlight that there is a discrepancy in transport availability between people of varying socioeconomic levels (Diaz Olvera, Plat, and Pochet, 2013; Lucas, 2011; Motte-Baumvol and Nassi, 2012; Zhao, 2014). Not only is there an inconsistency in transport availability, but also space itself is inherently uneven and inconsistent.

The spatial configuration of urban areas is not evenly distributed. Recent studies question how the production of the urban environment influences people (de Koning, 2009; Kapp and Baltazar, 2012; Nuijten, Koster, and de Vries, 2012; Silva, 2011). Urban geographers have explored the rapid development of urban
space and raised pertinent questions concerning spatial inequities (Cassiers and Kesteloot, 2012; Wainwright, 2008). Some geographers employ a critical perspective to address the social inequities, hierarchical nature of cities, and implicit and explicit uses of power (see Gillian, 2004; Peet, 2007; Peet and Hartwick, 2009; Schwanen and Mei-Po Kwan, 2009). More specifically, the critical discourse analysis (CDA) framework enables researchers to learn about the underlying meaning behind texts and relating that within the broader social context through the use of images and objects. This literature review surveys the contemporary research pertaining to the development of transportation systems in Latin American, multifaceted implementation of urban transport governance, and finally, the application of CDA.

Latin American Transportation

The Latin American transportation literature is small but covers diverse topics, ranging from the lack of public transit to the implementation of sustainable transport systems (Keeling 2013a). David Keeling (2008), one of the most prominent geographers examining Latin American transportation, has called for a new wave of geographical research to understand the relationship between development and transportation. To expand the minimal knowledge on the regional transport networks (Keeling 2002), transport geographers are employing novel methods to break down the complex nature of transportation systems, including the role that space plays in everyday mobilities and testing the effectiveness of transportation projects and their socioeconomic and spatial implications.
A growing body of scholarship examines the costs and benefits of the Metrocable system. For example, Keeling (2011) argues that some neighborhood reintegration via the Metrocable has increased residents’ access to transportation. But others show that there is no guarantee of increased mobility for those living farther away from the transit stations (Drummond, Dizgun, and Keeling, 2012). And although the Metrocable system can increase access to the central business district for some low-income communities, as well as play a symbolic and aesthetic role in the residents’ lives (Drummond, Dizgun, and Keeling 2012), the large investment can make the Metrocable cost prohibitive (Bacarejo et al., 2014). Although recent investment in the Metrocable system is fostering community support, questions remain about the degree to which all communities benefit. To some transport geographers, transport systems that are engineered to provide wider access are better investments.

Recent transit studies focus on systems that provide access at a reasonable price. For example, Jaramillo, Lizárraga, and Grindlay (2012) reveal the gaps in Bus Rapid Transit (BRT) systems that could be corrected by employing explicit measures that account for the socioeconomic factors in transport need. Similarly, Bocarejo and Oviedo (2012) use a travel-time budget and percentage of income spent on transportation to identify the effectiveness of transit policies in Bogotá and demonstrate the gap in current public transportation provision. To the authors, transit networks could be improved by redistributing transit fares based on accessibility to employment opportunities, and these benefits would outweigh the expansion costs. While these studies highlight the
gaps in the current systems, other transport geographers delve into experimental methodologies to assess the current state of public transit.

Transport geographers also have initiated novel methodologies to solve multifaceted urban transportation concerns. Enrique Fernández, de Cea, and Malbran (2008) present a methodology for solving the public transit design problem in Santiago, Chile. Their restructured transit system, based on mathematical modeling, would operate at lower costs compared to the current system, allowing government entities to modernize without issuing subsidies and increasing bus fares. Another method utilizes a BRT blog to examine transport exclusion. For example, Casa and Delmelle (2014) find that bloggers reference geographically, personal, societal, time, and fear-based exclusionary dimensions, which could potentially aid public policy makers in developing a more socially inclusive transit system.

Applying a geographic information system, Rodrigues da Silva, Manzato, and Pereira (2014) assess two spatial analysis methods to define a Functional Urban Region (FUR). The authors state that by improving the concept of FURs and understanding transportation flows and infrastructural shape, policy makers and planners can enhance policies and increase urban accessibility and mobility. Though the previous studies seek to improve local transport systems, other studies aim to understand the linkages between regional systems.

Regional transportation studies identify the interrelatedness of transport systems and the cities that they connect. For example, in an essay on Mendoza, Argentina, Keeling (2013b) describes an abandoned railway station that planners
have transformed into a regional transportation network between the MERCOSUR nations (Argentina, Brazil, Paraguay, Uruguay, and Venezuela). Marr and Sutton (2007) also discuss regional transportation networks in Michoacán, México and argue that while regional access has increased, access to the towns within the region remains unevenly distributed. The disproportionate spatial distribution of access hinders travel between the towns, thereby limiting the mobility of the region’s citizenry.

In other studies, transportation researchers find value in utilizing individual data to make conclusions about people’s travel behavior. For example, Munizaga and Palma (2012) build an origin-destination matrix from smartcard and global positioning system data for Santiago, Chile. Using two one-week datasets, they generate an estimation of time and position of alighting for over 80% of the boarding transactions. Rodríguez (2004) uses disaggregated data in Bogotá, Colombia to estimate voluntary and involuntary excess commuting to illustrate that the temporal and structural constraints in Bogotá prevent bank tellers from achieving a minimum commute time. Rodríguez suggests that policy makers could incorporate voluntary and involuntary aspects of excess commuting into future calculations. Studies that examine disaggregated data aids in understanding the region’s transit networks and how people interact with them. Another aspect of recent research centers on the growing number of private automobiles.

To many, the current growth of motorized transportation in Latin America is fueled by policies that favor the use of automobiles and is considered
unsustainable. For example, Hidalgo and Huizenga (2013) stress that Bus Rapid Transit is a major step in reducing private automobile usage and more region-wide agreements, such as the Foro de Transporte Sostenible, are crucial if the region is to develop on a sustainable path. Similarly, Khayesi and Amekudzi (2011) contend that a diverse and integrated coalition of actors is necessary to reduce automobile dependence and explain how urban planners and policy makers in Curitiba, Brazil can exploit policy windows to curb the use of private transportation. For many Latin American city planners, sustainable transport also signifies greater energy independence. By altering activity locations and current infrastructure in São Carlos, Brazil, Saunders and da Silva (2009) were able to reduce energy dependence by moving a supermarket to the center of the study region and establish bike-friendly infrastructure.

There is increasing complexity in Latin American’s transport system. Studies highlight the cost and benefits of transport investments. Other studies take on new methodologies to solve the problems partially caused by increased demand. Some transport geographers study the interconnectivity issues in regional networks, and sustainable transport plays a pivotal role in recent studies as well. Finally, several of the studies suggest a policy-oriented approach to solving transport issues. As detailed above, Bocarejo and Oviedo (2012) find that redistributing fares would be more effective than expanding the current public transit network. To better understand how policy is mitigated among governments, institutions, transportation planners, social narratives, and legal counsel, the next section examines scholarship on transport governance.
Transport Governance

Recent studies on transport governance confront transportation problems in a multitude of ways. While some researchers argue that transport governance should focus on low-carbon goals, others argue that transport policies can act as impediments in the successful execution of sustainable transportation. Several of these studies focus their attention on the implementation of transport governance at the urban level, where transportation is the most complex. A principle issue that emerges from the literature is the involvement of various players in the transport sector.

Transport governance is the social and economic coordination of the state and non-state actors in decision-making concerning transportation development. In a study on strong governance, unified metropolitan transportation authorities are a function of well-established governance and an administrative system in India (Agarwal and Chauhan 2011). However, according to the authors, unified transportation authorities fail to take individual interests into consideration. Banister (2011) also believes that strong governance is key to approaching sustainable transport within cities. To him, high mobility and technology will not be the solution to environmental problems caused by transportation. Instead, Banister counters that a combination of economic, planning, and technological innovations will help, but he questions its support among leaders. Some argue that there is value for local authorities to engage in projects that fund pilot carbon reduction initiatives and promote knowledge exchange (Tait, Laing, & Gray,
The push for more transport governance does have its opponents in the literature, who caution that too much governance is detrimental.

The myriad actors in transport governance and climate change policy complicate matters, rather than promote effective policy (Marsden and Rye 2010). Marsden and Rye use a multi-level governance framework to understand the policy environment in England and Scotland, capturing both the range of spatial actors and the influence of sectoral actors in a multifaceted institution. Likewise, Tait et al. (2014) argue that the combination of state and non-state actors can inhibit the successful implementation of low-carbon transport initiatives. In particular, these studies show how varying agendas can create economic, cultural, and policy barriers rather than generate a strong intra-urban network. Other studies shift the focus from the pros and cons of transport governance to understand the drivers of the change.

Land use and transportation are strongly co-dependent. By examining how the changes to land use and transportation policies take place, researchers find that a combined policy approach is paramount. Cascetta, Pagliara, and Papola (2007) reveal, through a series of flow charts, the complexity of urban transport systems and their integration into the broader metropolitan area. The authors contend that combined land-use/transport policies are necessary to manage the complex and unique nature of urban transportation.

By investigating the driving forces of transport demand and relevant policy measures, Li (2011), too, addresses the issue of balancing increased economic and urban growth while minimizing environmental destruction. Li critically
examines the existing literature on urban governance, suggesting that it is crucial to improve urban governance in transport infrastructure quality and develop efficient public transport, coupled with integrated land-use/transport planning as well as economic mechanisms. The literature emphasizes a joint approach to land use and transportation, while increasing urban transport governance is the key to improve the current transportation networks. Select research narrows the focus to the policy-makers who enact the initiatives.

Marsden, Mullen, Bache, Bartle, and Flinders (2014) show that decision-makers focus on individual choices related to travel, but do not believe that they work. Moreover, policy-makers are not very interested in changing travel behavior, as they believe that higher traffic levels are associated with increased economic activity. Similarly, Lindseth and Reitan (2007) study local institutions established for better coordination of environmental and transport policies in Kristiansand, Norway. The authors suggest that the case is an example of how groups of actors and partnerships can shape new discourses. Moreover, the authors state that urban governance relations are changing from a sectorally oriented mode of governance to a more open and inclusive style.

Macmillen and Stead (2014) also examine the discourses surrounding the idea of ‘best practice’ as it relates to walking and cycling policy. The study focuses on the ‘best practice’ notion to understand how walking and cycling policy is ‘produced’ and ‘consumed.’ The literature illustrates how decision-makers and varying actors participate in the governance process. By
understanding how governance looks on the ground, we can gain insight into uneven spaces and spatial concentrations of power (Griffin, 2012).

The literature reviewed here briefly discusses the role of discourse in urban transport governance. However, other social scientists have examined the role of discourses in more depth. The next section surveys the critical discourse studies literature to understand how narratives and control create power.

**Critical Discourse Studies**

Critical discourse analysis (CDA) is a relational framework for social research that focuses on the complex interactions between objects, words, institutions, power and persons (Fairclough, 2013). As one of the leading CDA researchers, Fairclough identifies ‘texts’ as the linguistic (e.g. grammar, narratives, metaphors) and semiotic (e.g. photographs, visual images) components of social life (Fairclough, 2005). Fairclough (2000) posits that text is central to understanding the production of social life, maintaining that people receive information generated from social systems experts and delivered via the mass media and Internet. Fairclough (2005) states that CDA examines four general research topics: the emergence, hegemony, recontextualization, and operationalization of discourses. Within these topics, Chouliaraki and Fairclough (2010) assert that theory and methodology are intrinsically connected. The four general components of CDA appear in several organizational studies to aid in understanding social life.

To some researchers, the widespread application of CDA in organizational studies is problematic. Leitch and Palmer (2010) conduct a content analysis of
organizational and management studies, finding that the loose interpretation and application of CDA harms its dependability. As a result, the authors institute a framework for text-based analyses to demonstrate how the researcher established the dialectical relationship between the linguistic and semiotic. In response, Chouliaraki and Fairclough (2010) maintain that CDA is not a systematic process and should not be confined to strict standards.

To that effect, Kwan, Clarke, and Wodak (2009) apply a CDA approach to highlight the power dynamics and interplay of multiple actors at various scales in the decision-making process. By using macro and micro scales in the use of discourse, the authors deliver a more balanced approach that relates the relative effects of agency and structure. Harrison and Young (2005) examine the discursive events in a government office, highlighting the effectiveness of the “Us versus Them” narrative given by a person of authority in a board meeting. As Faber (2002) suggests, this event helped to rally support and provide an organizational self. These studies reveal some applications of CDA and the inherent hierarchical nature in management that makes the approach so common. But, the hierarchical structure is not limited to organizational and management studies.

A series of CDA oriented studies focus on the nexus between power and discourse. Van Dijk (2006) employs a triangulated approach in his examination of manipulation. By relating discourse, cognition, and society, the author explains how political leaders, in this case Tony Blair, use ideological polarization and self-presentation to persuade the general public to support war. The more control
that persons of authority have over the public (e.g. thoughts and actions), the more power they will gain (van Dijk, 2001). Equally critical of power, Reyes (2011) explores the device of legitimization and the ways in which it is used to control the public: fear, the future, rationality, expertise, and altruism. By utilizing a CDA approach to examine presidential speeches during wartime, the author details how discourses are presented as truth to assuage people’s concerns and convince them that their position is the correct one. Some researchers further this argument by revealing how discourse and power can produce identity.

Wodak (2012) aims to identify the ways in which identity is constructed in Europe. She maintains that language and identity have a dialectic relationship that allows identities to be re- and co-constructed to provide distinction between Us and Them. Wodak (2013) again examines the creation of identity in Europe by delving into national citizenship exams as a way of assimilating immigrants. The author dissects the contradictions in a European nationalization movement, pointing to the continent’s multicultural and multilingual background. De Cillia, Reisigl, and Wodak (1999) focus on the discursive construction of national identity by analyzing press articles, interviews, and group discussions. The authors state that a CDA perspective to study everyday life is crucial in understanding the multidimensionality and renationalization of identity. However, the state is not always behind the construction of identity.

Less prominent social actors can manipulate and reproduce the dominant discourses. Recent studies use CDA to learn how and to what extent discourses differ from their mainstream media counterparts. Strom (2014) finds that
alternative hierarchies diverge from the typical Us versus Them binary in her study of Latino immigrants and their characterization in the news media. She concludes that the local Spanish-language news media represents Latino immigrants as the Us, even though Latinos are minoritized in the United States. Del-Teso-Craviotto (2009) argues that altered mainstream media discourses, such as those promulgated by marginalized Argentines in Spain, can provide a fruitful avenue for critical discourse studies. The author utilizes an Argentine online forum to learn how racist discourses are changed and disseminated in an unfiltered environment. In fact, Fairclough (2013) supports and calls for new studies to trace the relation between discourses and their contestations. Geographers, too, critically study discourse to understand power and spatial relationships.

Jayne (2012) studies the effects of discursive power in an analysis on mayoral politics, finding that unequal social relations and their discursive construction are locally complex and bound to space, scale, and the state. Petrova, Posová, & Sýkora (2013) examine the function of state and mainstream media narratives in the Czech Republic’s low-carbon transition. The authors suggest that local actors and the media drive the production of “satellite settlements” and have encouraged exurban sprawl. Critiquing this, Lees (2004) argues that critical urban geographers rarely disclose a clear methodology when using a CDA framework. The author concludes by encouraging critical urban geographers to begin with the discursive, detailing their methods, and then use it to create social justice in the city.
Summary

Researchers have applied the CDA approach to various fields across the social sciences. Though urban geographers adopted the CDA framework later than some fields (Lees, 2004), it has shown to be fruitful in relating the multi-layered elements of cities. While transport governance is a relatively new set of literature, it provides insight into governance-related decisions. Recent studies demonstrate how transportation planners, institutions, governments, and media combine to create and enact transport-related policies. Despite wide coverage across Latin America, transportation studies focus on single transport systems and not the energies behind them. Less understood is how alternative fuels grounded in discursive governance-based transportation initiatives impact the making of urban Latin America. Bolivia’s transition to CNG offers a compelling case to examine this issue.
CHAPTER 3

BACKGROUND

Introduction

Bolivia, a landlocked nation located in South America, is divided into nine departments or states (Figure 1). The Department of Santa Cruz is the largest department in land area and population. The physical and cultural geography of the Department of Santa Cruz is starkly different from the western portion of the country. Situated at the base of the Andean Plateau in Eastern Bolivia, the Department of Santa Cruz is known for its vibrant regional identity and entrepreneurial mentality, of which autonomy and free-market capitalism are the primary foci (Schroeder, 2007). The quest for departmental autonomy birthed the “Camba Nation” movement during the late 1980s and early 1990s (Schroeder, 2007).

Figure 1: Bolivia’s nine departments. Santa Cruz is the largest in area and population (produced by author).
The Department of Santa Cruz initiated a region-wide movement for autonomy that encompasses the Eastern Lowlands of Bolivia (Departments of Santa Cruz, Tarija, Chuquisaca, El Beni and Pando). Additionally, the discovery of the region’s second largest proven natural gas reserves in the Departments of Santa Cruz and Tarija reinforced these pivotal themes for Cruceños.

Santa Cruz is adjacent to the Piraí River, which runs along the city’s western municipal boundary. The autonomous city covers nearly 540 km², while the entire metropolitan area is about 1,407 km². Santa Cruz has a tropical savanna climate, receiving about 912 mm of rainfall per annum. Santa Cruz has an average annual temperature of 23°C and due to the climate and average rainfall, is categorized as Aw climate in the Köppen classification system. Santa

Figure 2: Santa Cruz sits 50 km from the base of the Andean Plateau (produced by author).

Figure 3: Santa Cruz is the most populated city in Bolivia (produced by author).
Cruz is considered to be a part of the Bolivia’s tropical lowlands and is approximately 430 m above sea level (Figure 2). Moreover, the city’s rapid growth has made it the largest in Bolivia (Figure 3).

According to the 2012 census, Santa Cruz’s metropolitan population is approximately 2.1 million people, making it the country’s largest metropolitan population. Santa Cruz’s metropolitan density is about 3,500 people per square kilometer, and more than two-thirds of the metropolitan population, roughly 1.4 million people, lives in the autonomous city limits. Santa Cruz is colloquially known as the *ciudad de los anillos*, or the “city of rings.” The city earned this nickname because of its concentric design, adding more roads, or “rings,” as the

![Figure 4: Santa Cruz’s concentric road design, highlighting the four innermost “rings” (produced by author).](image-url)
population increased (Figure 4).

Santa Cruz is experiencing a rapid influx of migrants. Much of the immigration to Santa Cruz has occurred over the last five decades and is due to the city’s growing employment, educational, and health care opportunities (Kirshner, 2013). According to the Instituto Nacional de Estadísticas (INE, Bolivian Institute of National Statistics) (2014), Santa Cruz’s population has increased by 22% since 2001. The city currently has a population of approximately 1.5 million people (Datos.ine.gob.bo, 2014) and is the 2nd fastest growing city in Latin America in terms of annual population growth (Citymayors.com, 2014). In order to move around the city, Cruceños have multiple options from which to choose.

The most common modes of transport are the private automobile, micro (public bus), taxi, trufi (fixed-route taxi), motorcycle, and motorcycle taxi. Expectedly, there are numerous vehicles on the road at any one time, and traffic congestion is a problem (Terrazas, 2014). Part of this is due to the increase in private automobile ownership. From 2001 to 2012, the number of households that own an automobile increased by 109% (Datos.ine.gob.bo, 2014). Yet approximately 67% of Bolivian households do not own an automobile (Datos.ine.gob.bo, 2014). The majority of Cruceños use the public transit system. The public transit system is minimally regulated and often congests major roadways near markets (Salek, 2010). These urban processes inform my overall research question: what is the role of discourse in Santa Cruz’s impending CNG transition?
Research Questions

Three subsidiary questions direct my research: 1) what is the CNG discourse produced by the Bolivian state? 2) What is the counter-discourse created by the residents of Santa Cruz? And 3) what is the dialectical relationship between the discourse and counter-discourse?
CHAPTER 4
RESEARCH METHODS & DATA ANALYSIS

Sampling Framework

This study utilized a mixed-methods approach. In order to examine the CNG phenomenon from a spatial perspective and across different socioeconomic groups, I stratified the city’s districts into three transportation categories: predominantly private, mixed public and private, and predominantly public. Like Kirshner (2013), I used the Programa de Alivio de Pobreza (2006) data that categorized the poverty level of the city’s 12 planned districts. The poverty index served as a representation for the transportation modes, where low poverty levels corresponded to the use of private transportation, and the districts with the highest levels of poverty used more public transit. I then ranked the 12 districts by poverty level (see Figure 5) and selected three districts to serve as private transport, mixed public and private, and public transit categories as it related to poverty level (e.g. the lowest, highest, and middle percentage of household poverty).

Next, I limited the study area by stratifying the transport categories into neighborhoods to facilitate the survey process. Each district in Santa Cruz is divided into unidades vecinales (UVs) or municipally defined neighborhood units. The number of UVs per district varied based on the area and the physical geography of the district. I collected the UV boundaries and numbers from the Environmental Systems Research Institute (ESRI, Esri_cy_BO, 2012). I placed the UVs in descending order and assigned numbers to each of the UVs. I then
used the SPSS random sampling engine to randomly select three numbers for each transit category.

Figure 5: Poverty levels by district in Santa Cruz. Data from Programa de Alivio de Pobreza (elaborated by author).

To reduce the sample population size, I selected three separate street blocks in each UV. I chose the street blocks based on a home density analysis from satellite photographs to ensure that I would be able to survey the most households in a limited amount of time. The data collection periods varied depending on the source. In the following section, I explain how I retrieved the data from the household and transit surveys and secondary sources.
Resident and Transit Surveys

To collect the CNG opinions from public and private transport users, I used a resident questionnaire and transit questionnaire (see Appendices 6, 7). I distributed the resident questionnaire to the inhabitants of the randomly selected UVs mentioned in the previous section. I designed the resident questionnaire to learn the participants’ familiarity with CNG and their sentiments about the CNG transition. The transit questionnaire was an abbreviated version of the resident questionnaire. I designed the transit questionnaire to be brief, as I intended to collect the responses while using varying types of public transportation. Though I had initially created the survey to disseminate entirely on the bus, it was overall inconvenient, noisy, and uncomfortable for the questionnaire respondents and myself.

First, I distributed the transit questionnaires at major public transit connection points. Specifically, I spoke with multiple university students at the Universidad Autónoma Gabriel René Moreno as they were waiting for the bus. I also distributed the transit questionnaires along the major public transit corridor, Avenida Grigotá. Many of these participants were entering or exiting the bus to go to the Mercado La Ramada. To disseminate the transit questionnaire, I approached the participants while we were on the bus or just before boarding.

I first asked them if they were interested in completing a short questionnaire about CNG. If they agreed, I explained the purpose of the questionnaire and read aloud, signed, and gave the respondent the approved survey participant form (Appendix 5). During the questionnaire, I sat or stood
next to the respondent while reading the options. I made certain that they were able to read the choices, but in most cases, I filled in their responses. By the time that I completed one questionnaire, nearby bus patrons overheard the conversation, which allowed me to complete multiple transit questionnaires in a short time span.

Second, I distributed the resident questionnaires and conducted the semi-structured interviews with residents from the three blocks within each UV (Figure 6). In addition to the type of transport on which they rely, the purpose of the resident questionnaire and interview was to reveal whether the participants decided to convert their automobile to CNG, why they chose to do so, and how

Figure 6: Survey sites located in districts two, seven, and twelve. SPSS randomly selected the UVs.
they felt about the CNG transition in general. Because it was difficult to administer the questionnaire to the heads of household (HOH) on each block, I instead interviewed people who I encountered and agreed to talk. Though not ideal, this enabled me to administer 30 resident surveys, approximately 3 - 4 from each block.

During the resident survey of the three districts, I approached people who were on the sidewalk, in cafés, and in parks to ask them if they would complete the questionnaire and brief interview. I explained the purpose of the research to them, read the consent letter aloud, signed the letter, and gave it to them to keep. At the beginning of each semi-structured interview, I asked the participants if I had their permission to record the conversation with a digital voice recorder. Each questionnaire and interview took approximately 10-15 minutes to complete and depended on the number of preferred modes of transportation and the respondent's knowledge of CNG. I did reach my desired goal of 10 responses per district, totaling 30 questionnaire responses for the neighborhood survey. While this adjustment did help me ascertain more questionnaire responses and interviews, it did introduce some participants who did not necessarily live in that same district. Thus, my results were not limited to the three districts, as I had originally envisioned. The interview consisted of several open-ended questions that gave the respondent the opportunity to inject their opinion and experiences of the government policies and the conversion to CNG.

In another component of the survey process, I held focus groups with participants from varying socioeconomic levels. I arranged two focus groups, one
with construction workers and brick masons and another with a middle-class family. Although I did not select focus group participants randomly, the focus group data provided a way to capture some sentiments about transportation issues, especially if they reflected a theme in the transit and resident surveys. The focus group questions contained similar questions as the resident questionnaire, though it heavily relied on the discussion amongst the participants.

Discourse

My second objective was to learn the prevailing discourse concerning CNG in Santa Cruz. To do this, I gathered government documents and newspaper articles regarding the transition to a natural gas based transport network. I collected the qualitative data from August 2013 to December 2014. The primary sources of the government documents came in the form of informational newsletters generated by the EEC-GNV, Agencia Nacional de Hidrocarburos (ANH, National Hydrocarbons Agency) and the Ministerio de Economía y Finanzas Públicas (Ministry of the Economy and Public Finance). The newspapers from which I collected social narratives included El Deber, El Día, La Razón and El Mundo. I searched the government and periodical websites using key phrases, including “gas natural,” “GNV,” “transporte urbano,” “matriz energética,” and “conversión” to uncover the social narratives embedded in Santa Cruz. I also followed the EEC-GNV Twitter handle and YouTube webpages to uncover any potential narratives in real-time. Moreover, I was able to use these social narratives to compare the government’s standpoint with the perceptions of public and private transport users.
After finding an article, I read it and highlighted the keywords that I used to search. I also wrote notes to encapsulate 1) the general sentiment of the article, e.g. for or against the CNG conversion 2) the benefits and for whom 3) and the source of the data. After I read approximately 10 articles, I found specific trends and common topics that the authors repeatedly discussed. At that point, I quantified the common discourses, assigning a numerical identifier to the common themes. In total, I read roughly 75 articles to identify nine social narratives. In the next section, I reveal those social narratives and compare them to the public and private transportation user data.

The methodology draws heavily on Michel Foucault’s work on discourse and counter-discourse analysis. Discourse, as Foucault (1972) explains, is not the “confrontation of a reality and a language, but rather the fusing between words and things. By performing a discourse analysis, one is breaking the grip between words and things to better understand their placement, order, and meaning. More specifically, Foucault (1972) defines discourse as, “as the group of statements that belong to a single system of formation.” In this study, I collected the primary and secondary data, or texts (see Fairclough, 2005) to perform a discourse analysis. While analyzing the prevailing discourses, I discovered several counter-discourses that challenged those from the point of authority.

The semi-structured interviews revealed a counter-discourse that butted against the government’s version of the CNG transition. As Deleuze and Foucault (2007) described, the counter-discourse enabled the formerly voiceless
public to create its own language and resist either a perceived or real oppression. To dissect the multiple discourses, I separated them into public transportation owners and operators, public transportation users, and private transportation users. The next section discloses the results from this study.
CHAPTER 5
RESULTS

Public Transportation Owners and Operators

Several bulletins released by the Entidad Ejecutora de Conversión a Gas Natural Vehicular (EEC-GNV, Executing Entity for the Conversion to Vehicular Natural Gas) illustrate the amount of direct savings to the public transportation driver (Figure 7). The EEC-GNV estimates that the public transportation drivers will save approximately 2 Bolivianos, or $0.29, per liter compared to using diesel fuel. The government’s argument that this will save the driver money stems from the design of the payment system. At the end of the workday, the cost of fuel that the driver used is deducted from the amount of bus fares that they received.

The ‘bus driver savings’ discourse is explained in a promotional video uploaded to the EEC-VNG YouTube webpage, titled “100% a GNV ahora, rinde no contamina” (EECGNV, 2014). The bus drivers in the video state that they

MÁS AHORRO PARA EL TRANSPORTISTA, MÁS AHORRO PARA EL PAÍS

El transportista que antes gastaba Bs. 3.72 por litro de diésel, ahora gastará con GNV Bs. 1.66 generando un ahorro de Bs. 2.06 por litro de combustible consumido. El Estado ahorrará anualmente más de 19.200.000 de bolivianos por año con el plan piloto.

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Fuente: EEC-GNV

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</tbody>
</table>

Fuente: EEC-GNV

Figure 7: Example of the ‘bus driver savings’ and ‘government savings’ discourse. Source: EEC-GNV Informa, July 2014 issue.
save 60% on daily fuel costs. Before the conversion to CNG, one bus driver says that he spent 180 Bolivianos, or $26 in October 2014, on diesel fuel. Another bus driver follows by saying that he is currently only spending 80 Bolivianos, or $11.50 in October 2014, on a daily basis. By reducing the cost for fuel, the government states that the drivers will earn a higher profit.

Additionally, the documents introduced a ‘bus owner savings’ narrative in the informational bulletins. The Bolivian government offsets the costs of changing the motor to CNG from diesel by paying 50% of the conversion expense (EEC-GNV, 2014a p. 5 para. 1). Santa Cruz is the first Bolivian city to experience this pilot program, which began in 2013. According to the GNV Informa (EEC-GNV, 2014a p. 4 para. 1), the government has converted 70 public buses in Santa Cruz. The documents associated the operating costs for the bus drivers and owners with an overall savings for the Bolivian government.

According to the newest EEC-GNV (2014a p. 1) estimates, the Bolivian State will also save as a result of the pilot program in Santa Cruz. Currently, the Bolivian government applies a subsidy to both diesel and gasoline fuels. Diesel and gasoline fuels are imported from other countries due to the lack of oil refineries in Bolivia. By eliminating these subsidies, the government proclaims that it will save money through the initiation of the pilot natural gas conversion program. The calculated savings is approximately 320 Bolivianos, or $46 in October 2014, per vehicle per day. Over the course of one year, the government states that it could save almost $14,000 per vehicle (EEC-GNV, 2014a p. 1). Once this is multiplied to address the conversion of 400 buses, the savings is
estimated at $5.6 million dollars for the federal government. Though the government documents include the amount of savings for these three groups, they do not mention the savings for public transportation users.

In one YouTube video, the EEC-GNV (2014b) advertises the ‘quality’ of the new motors for the pilot public transportation initiative. An American states in English, “These engines were manufactured in the United States and operate on GNV” (Gas Natural Vehicular in Spanish). However, the Spanish translation of his statement differs slightly in an attempt to bolster their reliability. In Spanish it says, “These high quality engines were manufactured in the United States and operate on CNG.” Though the difference is minimal, the EEC-GNV wants to remove any doubt about the dependability and quality of the motors to encourage public transportation owners to convert their bus fleet.

The ‘quality’ narrative continues in a series of photographs and articles regarding governmental oversight during the installation process (Figure 8). In these EEC-GNV photographs, certified mechanics are installing the CNG canisters on various vehicles. In adjacent photographs, installation experts are speaking amongst one another and are consulting with the mechanics. Brief articles, such as one from the GNV Informa (EEC-GNV, 2014a p. 5 para. 6) issue, state that, “Parliamentarians verify that the installations are suitable and equipped according to the contract with the EEC-GNV to guarantee the vehicle’s owners receive a good quality CNG transformation.” It continues with a quote from one of the parliamentarians, “We saw that the engines possess the latest technology and spoke with experts who came from the United States to complete
the engine swap.” While previous bulletins showed certified mechanics, this was the first newsletter that mentioned the involvement of American engineers.

Public Transportation Users

The ‘public transportation users benefit too’ narrative appeared in the several survey responses. Of the 37 responses collected in May 2014, I found that many public transportation users do, in fact, believe that they do or will directly benefit from the country’s CNG transformation (Figure 9). Fifty-eight percent of the public transportation participants said that the greatest effect of the CNG transition is the decreased transportation costs (Figure 10). One respondent said, “It does affect me because it lowers my transportation costs…natural gas is cheaper.” However, when I asked the public transport users

Figure 8: Example of the ‘quality’ narrative. Certified mechanics installing and recalibrating CNG canisters. Source: EEC-GNV Informa, July 2014 issue.

Figure 9: Does CNG affect your daily mode of transportation?

Public transport users (n = 37)
if they would convert their vehicle to CNG if they had one, the results were mixed (Figure 11).

Private Transportation Users

While several of the public transportation respondents seemed to have absorbed the prevailing ‘consumer savings’ rhetoric, private transportation users were more hesitant to convert their vehicles to CNG. The EEC-GNV also targets private transportation users in their bulletins, videos, billboards, events, and social media accounts. While the public transportation users perceived to receive

Figure 10: What is the primary effect of CNG on your daily mode of transportation?

Public transport users (n = 24)

Figure 11: Would you convert your automobile to CNG if you owned one?

Public transport users (n = 37)
a benefit from the conversion to CNG, private transportation users expressed skepticism about the actual benefits. Despite their doubts about the new transport energy matrix, the current cost of a liter of gasoline in Santa Cruz is more expensive than CNG.

As of December 2014, a liter of regular gasoline (87 octane) cost 3.74 Bolivianos per liter, or $0.54 per liter, while a cubic meter of CNG costs 1.66 Bolivianos, or $0.24 per cubic meter (ANH.gob.bo, 2014). Bolivians have taken notice to the approximate 44% reduction in cost. Results showed that the ‘consumer savings’ narrative has entered the sample’s dialogue. Of the 18 private transportation respondents, 50% stated that CNG has an effect on their daily transportation (Figure 12). I spoke with one woman who told me, “I was spending 400 to 600 Bolivianos ($57 - $86) a week because everyone was driving my truck. I decided to switch to save money. After I switched, I spent about 100 Bolivianos ($14) on CNG weekly.”

Out of the nine respondents who stated that CNG did affect their transportation, eight of them said that the primary benefit was cost (Figure 13). And based on the secondary data collection, the costs are in fact lower for those whose vehicles are powered by CNG. Even several of those who had not converted their automobiles agreed that the price of CNG is cheaper and would decrease their short-term transportation costs. However, among the same nine private transportation respondents, 33% stated that converting their automobile to CNG damaged the motor (Figure 14).
Figure 12: Does CNG affect your daily mode of transportation?

Private transport users (n = 18)

Figure 13: What is the primary effect of CNG on your daily mode of transportation?

Private transport users (n = 9)

Figure 14: What is the secondary effect of CNG on your daily mode of transportation?

Private transport users (n = 9)
To verify this sentiment, I spoke to a mechanic who converts vehicles to CNG. He said, “The conversion does damage the motor over time. People convert because they want to save money, but they will have to buy a new motor in a couple of years.” This statement contradicts the EEC-GNV’s promotional videos and newsletters, in which the actors and authors state that CNG is a reliable fuel for everyday transportation, and that certified mechanics ensure that the conversion is performed correctly. The dichotomy between the two statements demonstrates that there can be differences among discourses and outcomes in the CNG transition.

The Bolivian government and associated entities, such as the EEC-GNV and ANH, aim to establish a new transportation energy matrix. My sample, however, expressed more concern with intra-urban mobility, saving money, and protecting the life of their motor. Moreover, a government initiated subsidy for residents to convert their automobiles to CNG enables automobile owners to convert their vehicle without paying anything, but only if a certified CNG mechanic converts their vehicle.

One of the least effective private transportation narratives that engulf the marketing campaign to private transportation users is that the conversion to CNG is ‘100% free.’ Several of the bulletins, infographics, and videos presented here (e.g. Figure 15) encouraged private transportation owners to convert their cars because there was no cost to them to do so. For example, one video posted on the EEC-GNV’s (2013, October 4) YouTube webpage encapsulated the private
Figure 15: Example of ‘100 % free’ narrative. The top says, “Since 2010, more than 100,000 vehicles have been converted to CNG for free. Committed to our country, we continue moving with the energy matrix transformation.” Source: EEC-GNV Twitter page.

Figure 16: Example of ‘100% free’ narrative. The tweet says, "Thanks to the nationalization of hydrocarbons, Bolivians can convert their cars to CNG for free!!" The banner in the photograph says, “Nationalized, property of Bolivians.” Source: EEC-GNV’s Twitter page.
transportation discourse in just 30 seconds, “Don’t sleep,” it begins, “Everybody is converting their cars to CNG because they save money, because they care about the environment, because it’s reliable. Thanks to the nationalization of natural gas, the tank and installation are completely free!” A similar rhetoric appears in a Twitter post about the nationalization of natural gas (Figure 16).

Though the ‘100% free’ narrative is widespread in the documents and videos that I researched, the survey participants rarely mentioned it. In fact, only 28% of automobile owners claim to have known about the subsidy when asked on the questionnaire (Figure 17). One respondent who had already converted his automobile stated that he paid for the conversion outright. The respondent did not know if he went to a certified CNG installation shop.

A smaller subset of participants believed that the CNG conversion was ‘dangerous,’ which deterred them from converting their automobile (Figure 18). Of the total 18 private transport respondents, three felt that the technology was not yet ready for widespread implementation and installation deserves further regulation. In the semi-structured interview, the same three respondents reported hearing cases where the natural gas canister had been punctured or exploded due to improper installation (Figure 19).
Figure 17: Do you know that there are CNG subsidies that pay to convert and fuel your automobile?

Private transport users (n = 18)

Figure 18: Do you think that using CNG is dangerous?

Private transport users (n = 18)

Figure 19: Why do you think CNG is dangerous?

Private transport users (n = 3)
Based on the secondary data collection, there are issues with the canisters’ safety. According to two separate articles from El Deber (2014a, b) mechanics removed the CNG tanks in thousands of automobiles because they needed to be inspected and possibly replaced because they presented an explosion hazard. The private transport users’ ‘dangerous’ narrative did have a governmental counterpart in the form of ‘safety.’

The government’s ‘safety’ narrative was limited in scope. For example, photographs are a primary method for demonstrating the safety of the installation process. In some photographs, certified mechanics were shown with a hard hat and some had protective eyewear while installing the canisters (see Figure 12). Up close shots of the installation depict the mechanics ensuring that the canister was properly tightened and in place. Moreover, some of the promotional videos also mention the safety of the CNG tanks (EECGNV, 2013, July 17). The videos

Figure 20: Example of the ‘environmentally friendly’ narrative from ANH infographic. Notice the car is a personal automobile. The bottom of the flier says, “CNG is clean energy, safe, and environmentally friendly.”
state that the CNG canisters are tested by technical professionals and had undergone durability and erosion tests to determine if they were safe for use. Based on the participants’ responses in this study, most were not concerned with the safety of the installation process and felt that the tanks were harmless.

The ‘environmentally friendly’ narrative was promoted often in the government documents that I reviewed. However, this social narrative was the least prevalent among the sample population. Private users never mentioned the environmental benefits from converting to CNG, even though the government documents directed the narrative towards private transport users (Figure 20).
CHAPTER 5
DISCUSSION

Discourse, Counter-Discourse, and Outcomes

The primary and secondary data analyses revealed several key themes. From ‘safety’ to ‘quality,’ the discourse played a prominent role in how or if the respondent interacted with CNG and experienced the transition. CNG governance appears to be in Santa Cruz for the foreseeable future, as the major media outlets in Santa Cruz continually promote the government narratives. Moreover, government agencies, such as the EEC-GNV, now spread their message through social media accounts. However, the vast majority of the sample population said that they heard of the benefits from the news on the television.

The CNG policies, programs, and advertisements have an accompanying social narrative, influence on the CNG material (e.g. its demand, pricing model, service stations, and conversion shops), and a desired outcome (e.g. increased domestic CNG consumption). In the results section, I identified the prevailing discourse through government policies and incentives. However, the mere identification of these two components does not define the CNG governance process. Rather, it shows two related parts in the totality of the complex governance structure. The following flow chart illustrates the role of the governance strategy in the sample population’s opinions and daily transportation decisions.
Figure 21 conceptualizes the CNG phenomenon and unites my overarching thesis question and ancillary research questions. Figure 21 shows that the public and private transport users play a pivotal role in the actualization of this process. For example, the governance strategy is designed to convince transport users, both public and private, that the implementation of CNG is beneficial to Bolivians. Without their support and increased consumption habits, Bolivia is unable to move forward with their natural gas energy matrix plans.

My results show 65% (see Figure 9) of the public transport sample population believes that CNG impacts their daily transportation. While some of these participants used taxis, which have high rates of CNG conversion, 24 of the 37 respondents listed the bus, which have low rates of CNG conversion, as their primary mode of transportation. These results suggest that most of the public transport users in my sample population are either 1) absorbing the
prevailing state discourse or 2) supportive of the CNG policies and would promote them if they felt that it benefited them or not. In regards to converting a hypothetical automobile to CNG, public transport users were more skeptical but overall supportive. Fifteen out of the 37 participants said that they would convert to CNG if they owned an automobile. While public transport users do not have a choice of converting an automobile at the moment, the discourse has permeated from the top down. Since public transport users do not have an automobile, their opinions are the actualizations of the CNG transition.

CNG governance is currently targeting the upper socioeconomic groups, as they are the ones who own or have access to automobiles. Personal automobile owners can in fact realize the benefits of the urban transport governance regarding CNG; the cost to fill up their automobile at a CNG service station is lower than conventional gasoline and diesel, and the conversion costs are entirely subsidized by the Bolivian Government, if the owner takes the vehicle to a certified conversion shop. However, the majority of the population who relies on public transportation – buses, taxis, and fixed-route taxis – benefits less from CNG.

Public transport owners and operators and private transport users can benefit from the CNG transition. Though the benefits between the two groups do vary, these groups have a choice to convert to and fuel their vehicles with CNG. Of the 18 private transport users with whom I spoke, only 5 knew of the available CNG subsidies. This suggests that very few participants in the population sample actually understand all the benefits that they receive as private transport users.
This could prevent the widespread acceptance of CNG as a primary fuel source and hinder the government’s CNG initiatives. If there is little demand for CNG among private transport users, it suggests that the government has thus far missed its primary target.

Much of the discourse from the government side became a part of the sample population’s lexicon (see Table 1). This is especially true in terms of ‘savings.’ Both private and public transport users continually said, “El gas es más económico. Hace daño al motor pero se abaratan los costos.” In other words, CNG is cheaper for them to operate their automobile, which outweighs risk of shortening the life of the motor. While private transport users do have the opportunity to save, public transport users are at the mercy of public bus owners, as they are not owned and operated by the city. Though some participants mentioned the prevailing discourse, others generated their own counter-discourse.

In this case study, the counter-discourse emerged from the public transport users. For example, public transport users stated that the CNG conversion damages one’s automobile despite not actually owning one. While it is unlikely that this group created this narrative, some of the sample population propagated it. This negative opinion of the CNG transition shows the reciprocity of the state’s discourse and their desired outcome. Current public transport users could influence CNG’s future in Bolivia. It is conceivable that some of the current transport users could become automobile owners in the future. If this counter-discourse continues, then it could potentially decrease the internal demand for
CNG, effectively counteracting the prevailing discourse’s primary object: consume more CNG.

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<td>Public Transportation Users Benefit Too</td>
<td>Photographs showing pedestrians boarding buses</td>
<td>EEC-GNV GNV Informa</td>
<td>58% believe CNG affects daily transportation</td>
</tr>
<tr>
<td>Consumer Savings</td>
<td>&quot;Don't sleep! Everyone is converting to CNG because it's safe!&quot;</td>
<td>EEC-GNV YouTube videos</td>
<td>&quot;Why would I convert? I can afford gasoline, it's also cheap. There's no need.&quot;</td>
</tr>
<tr>
<td>100% Free</td>
<td>&quot;Converting your vehicle is FREE&quot; &quot;Tank and installation are completely free&quot;</td>
<td>Twitter and EEC-GNV webpages EEC-GNV YouTube videos</td>
<td>&quot;I paid for my conversion.&quot;</td>
</tr>
<tr>
<td>Dangerous</td>
<td>&quot;4,000 CNG canisters are recalled and will be inspected for faults.&quot;</td>
<td>Mainstream media</td>
<td>&quot;I've heard that they (the canisters) can be dangerous if they are not installed correctly.&quot;</td>
</tr>
<tr>
<td>Safety</td>
<td>Certified mechanics wearing eye protection, hard hats &quot;CNG is safe and reliable.&quot;</td>
<td>EEC-GNV GNV Informa</td>
<td>&quot;It's not that dangerous. I don't worry about it because I start my car with the gasoline, wait, then switch to CNG.&quot;</td>
</tr>
<tr>
<td>Environmentally Friendly</td>
<td>&quot;CNG is clean enery and environmentally friendly.&quot;</td>
<td>EEC-GNV GNV Informa</td>
<td>&quot;CNG is better for the environment.&quot;</td>
</tr>
</tbody>
</table>

Table 1: Competing discourse with associated propaganda and interview highlight from sample population.
In EEC-GNV photographs advertising the conversion to CNG, bus patrons are depicted as a beneficiary of the conversion program. In the specific sections of the pamphlets where public transportation is mentioned, photographs show public transportation users boarding a bus in Santa Cruz. The placement of these photographs along with statements, such as “For the first time, the public transport sector benefits with a loan from the Plurinational State of Bolivia (EEC-GNV 2014a p. 5),” is not an accident (Figure 22).

Figure 22: Excerpt from GNV Informa showing bus patrons along with 'savings' discourse. The far left paragraph title says, “Public Transport will only pay 50% of the costs for changing the motor.”

Contradictions

In the documents reviewed here, I did not find any indication that the bus owners or government have plans to reduce the costs that would directly impact the public transportation users. In fact, the bus fare actually increased for transit users during the period in which President Morales has been in office. In 2012,
the bus fare in Santa Cruz rose from 1.80 Bolivianos to 2 Bolivianos, or $0.26 to $0.29 (El Deber, 2014). Though this increase could be caused by inflation or even increased operating costs, it suggests that the fare for public transport users will continue to increase despite lower fuel costs for the owners and operators. However, the pilot CNG bus conversion program is still in its infancy. Based on the GNV Informas, the public transport owners will incur new costs, approximately 50% of the motor’s cost, for the diesel to CNG engine exchange; the government will subsidize the remaining amount.

The lack of direct benefit to the public transport users contradicts the government’s dominant discourse. Based on the transit interviews, many of the participants confused the actual benefits to public transit users. In order to push the ‘savings’ rhetoric, the CNG governance continues to release a series of informative pamphlets to illustrate how everyone can potentially benefit from the CNG energy matrix transformation. However, the data clearly shows that the primary beneficiary is the state.

According to El Deber (2014), the Bolivian government will save $3.2 million in 2014 from the conversions to CNG. Rather than rely on oil refineries in Brazil, the Bolivian government has invested in multiple natural gas refineries throughout the country with several others in the planning stages. Therefore, the extraction and production of natural gas is an entirely domestic process. Additionally, based on several speeches given by President Morales, the neoliberal model of extraction and exportation did not benefit the Bolivian people (El Deber 2014). And the new economy – geared toward domestic consumption
of the growing middle class – provides greater social and spatial mobility and aid to people of the lower class.

Bolivia’s Nuevo Modelo Económico, Social, Comunitario y Productivo (New Economic, Social, and Productive Model) (2011) details the government’s plan to transform the nation’s economy. According to the Nuevo Modelo, the new state-directed development funnels money to social programs and contributes to social inclusion. Under the “plural economy,” the comunitaria pillar receives money from the state. The money is then distributed to multiple government agencies that aim to alleviate poverty and increase employment. While it is not the point of the study to dissect the workings of the Bolivian economy, this presents a dichotomy between what the government is saying and what it is doing.

CNG and roadway infrastructure is limited, but increasing, in the outskirts of Santa Cruz. According to the Programa de Alivio de Pobreza (2006), the poverty level also increases as one moves farther away from the city center. Many of the residents in this area use public transit to travel to their jobs in other parts of the city. When I visited district 12 to conduct the qualitative data collection, buses passed through the district’s main road every 30-60 seconds. The increase in bus fare only complicates mobility for those who are already economically disadvantaged. The spike in bus fare seems to counteract the Nuevo Modelo by placing more pressure on lower income groups. And though the bus companies are private, the Cuatro Pilares clearly declares that the state is to manage and redistribute wealth through public-private partnerships.
As in Bocarejo and Oviedo’s (2012) study, a public policy approach, in regards to lower prices with CNG, could assist the residents in outlying neighborhoods and increase their employment opportunities. This process would also require that the transport governance strategy focus on providing a bus fleet that primarily runs on CNG. While this is a major investment that necessitates the state and private entities to work together, the government has an opportunity to shift their attention to lower income groups, further redistributing wealth and spatial equity. In fact, since my field research, the government has devised a plan to convert over 400 buses to CNG (El Deber, 2014). Yet, there is still no indication that it will impact the bus fares, and therefore increase mobility and access to employment for the public transit users.

In terms of Bolivian travel behavior, the private transportation sample group had differing opinions on converting their automobiles. In fact, many respondents stated that the conversion could decrease their mobility due to improper installation. Unintended consequences such as this one could be a setback for sustainable transportation goals. Even though the state-level Bolivian CNG narrative emphasizes the importance of protecting the environment through the use of low-carbon fuels, none of the private transport sample mentioned the potential environmental benefits related to CNG. Tait et al. (2014) and Banister (2011) argue for greater governance to mitigate the environmental concerns as a result of transportation in cities. In Santa Cruz, and Bolivia in general, the CNG governance is present, but according to my results, the sample’s awareness
concerning increased carbon dioxide emissions is lacking. As the CNG governance is currently envisioned, it could facilitate the use of automobiles.

Santa Cruz has its share of congestion and transportation network problems (El Deber, 2013). CNG might play a role in the future of automobile dependency, further shaping urban space. Though according to some participants in this study, there is no need to convert to CNG because gasoline and diesel are relatively inexpensive, cheaper fuel costs could possibly be the impetus for car ownership for those who cannot currently afford the fueling and maintenance of an automobile. If the Bolivian government proves successful in its efforts to increase CNG usage through lower fuel costs, the already crowded highways of Santa Cruz may reach capacity more quickly. Lower fuel costs could also encourage car owners to live farther away from the city center. Consequently, this could lead to greater socio-spatial division, traffic congestion, and greater infrastructural development for private automobiles.

Similar to what the United States experienced in the 1950s, Bolivia is seeing many of its wealthier residents move to outlying communities. These urbanizaciones are situated on the periphery of the city, thereby increasing commuting time and costs for its residents. As more residents desire to live outside the second “ring,” land values have are becoming comparable to downtown Santa Cruz. Though the current economic impact on the residents may be insignificant, this could change if President Morales removes the nation’s gasoline subsidy (Al Jazeera, 2011). The removal of the gasoline subsidy could encourage more automobile owners to convert to CNG.
As Li (2011) suggests, it is critical that the urban transport policies attempt to balance both economic and urban growth. CNG policies do not necessarily decrease automobile use, but it has the potential to improve air quality. To curtail the environmental destruction caused by outward expansion, the city will need to develop a land use/transportation plan that is centered on public transit and improved infrastructural development (Li, 2011). By balancing the city’s growth, the policies could align with the 'environmental' narrative. However, this process presents a discrepancy in the effectiveness in urban transport governance. A key component in the pro-governance literature is improved infrastructure. The infrastructural projects that are currently taking place in Santa Cruz are automobile-oriented.

In Santa Cruz's center, the number of infrastructural projects, automobile use, and CNG conversion and service stations continue to grow (Datos.ine.gob.bo, 2014). Upper socioeconomic groups benefit from the implementation of CNG-related infrastructural development in Santa Cruz. As shown in Figure 24, the certified CNG conversion stations are located in the districts with the lowest poverty levels. As a result, the public-private relationship leads to ‘modernization’ as Nasongkhla and Sintusingha (2013) contend. The CNG transition shapes urban space, making it more homogeneous while facilitating travel for those who own automobiles.

Recommendations for Future Research

Follow-up studies in other Bolivian cities could be crucial in understanding the CNG phenomenon. By examining cities that have a more comprehensive
transportation plan, such as La Paz, researchers may be able to see if the middle-class is integrated into the future transportation outlook. Moreover, it could reveal the link between development and transportation at a regional scale, which Keeling (2008) states is critical for Latin America’s future development. As Hanson (2006) suggests, engineers have largely dominated transportation studies and subsequently passed down the questions and methodologies that several transportation geographers use today. Future studies could take a critical stance on power and control regarding public and private transportation studies. By using the Transportation Research Board’s (2005) critical issues as a starting point, geographers can dissect the non-quantitative components of transportation to provide an insight into transportation as a social process, rather than an isolated component of society.
CHAPTER 6
CONCLUSION

In this study, I critically analyzed the CNG transition in Santa Cruz, Bolivia. The objective of this work was to better understand the discourse during the CNG transition and its impact on urban space in Santa Cruz. By collecting questionnaires and conducting semi-structured interviews with a sample of Santa Cruz's residents, this study presented the CNG transition – the infrastructure, policies, narratives, and people’s experiences with, and opinions of, the alternative fuel. This study sought to identify the dominant discourse from the state and non-state agencies, counter-narratives from the general public, and uncover the dialectic between the discourse and counter-discourse.

In general, public transport users seemed to be more supportive of CNG than private transport users, though they had significantly less experience with the fuel. The discourse and counter-discourse analyses revealed that Santa Cruz is divided on the benefits of CNG. It is clear that private transport users have the opportunity to save money by converting their automobiles. Moreover, the Bolivian government does not obscure the benefits that it will incur by transforming the country’s energy matrix. The natural gas energy matrix is already shaping Santa Cruz. Thus far, CNG conversion shops and service stations are mostly within the first four “rings,” but are increasing along major corridors that lead to the city center.

Private transportation users in this study were aware of savings. Though most private transportation users, about 83%, did not know that the natural gas
was subsidized, they were familiar with the lower cost of CNG when filling up their automobile at the service station. This suggests that the government’s public service announcements have not effectively changed people’s thoughts and behaviors. Considering the number of respondents who mentioned the damage incurred to the automobile’s motor, approximately 29% of total respondents, the counter-discourse is making an impact. The most prominent of the counter-discourses is that CNG damages the vehicles motor over time. While some mechanic experts ensured me that this was the case, some taxi-drivers rejected this idea. Several taxi-drivers blamed the owners for the motor damaging the motor. In particular, one taxi-driver said

No es la verdad cuando la gente dice que el GNV hace daño al motor. En realidad es que la conversión hace daño a dos o tres partes pequeñas del motor, pero son baratas...no son caras. No es todo el motor como la gente dice.

It is not the truth that CNG damages the motor. Really, the CNG conversion wears down two or three small parts of the motor, but they are cheap...they are not expensive. It is not the entire motor like some people say.

The quote above is a prime example of the power of the counter-discourse that was prevalent amongst the sample population. The counter-discourse was so powerful that it permeated the public transportation users thoughts.

Based on the political leaning of some Cruceños, it is likely that the anti-CNG discourse originated here. It became apparent when talking to some of the
participants that they were against the domestic consumption of CNG. The regional contestations and political differences between the lowland and highland people’s of Bolivia could possibly play a role in the creation of both the discourse and counter-discourse. Since President Morales is from the highlands, the political slant favors that of the highland people, who favors the domestic use of CNG. As Foucault (1972) explains, those who create the counter-discourse are doing so because they do not believe that they have a voice. Similarly, van Dijk (2006) states that persons of authority use language to manipulate the public to relinquish power.

The idea of power here is key. The contradiction between the CNG discourse and Nuevo Modelo is profound; on one hand the government is advertising the benefits to the Bolivian people, while claiming that the state is funneling excess funds from the natural gas industry to social welfare programs. While the state may be bolstering its social programs, we have seen that the benefits are limited and currently help the middle and upper class residents of Santa Cruz. Even more, the state government has garnered enough power to convince some of the general public that the Nuevo Modelo is somehow a socialist construct. The Bolivian government remains tied to its neoliberal past and continues to carry a free-market ideology, though this time the funds run through the state rather than private companies. The data analyzed here suggests that the discourse has shown to be powerful enough to manufacture consent (Chomsky and Herman, 1989).
Research has shown that the Morales administration has exploited the country’s natural gas reserves at the expense of multiple indigenous groups in Bolivia’s lowlands (Hindery 2013). Clearly, the state is more concerned with growing its economy by becoming a free-market trader than pursuing a purely socialist model as purported by the President Morales and the Bolivian mass media. The neoliberal model in Bolivia is still alive, albeit in a different form. The discourse surrounding the CNG transition shows that Santa Cruz’s residents are now on the other side of the struggle. Thus, it seems that the current Bolivia is a hegemonic state (Gramsci 1971 [1929-35]), as the CNG transition and neoliberal ideology serve to increase wealth for the elite.

This transition to CNG is a defining time in Latin American transportation. As the region propels to 80% urban by 2040 (United Nations, 2014), transportation problems will grow ever more complex. CNG remains a relatively novel transport application in Bolivia. While some see it as the future of transportation that benefits everyone, others oppose its continued infusion and deem it unnecessary. CNG’s future will predominately depend on governance – public policies, private enterprise, discourses, government agencies – and the public’s perception of equity, air quality, congestion, and transportation costs. Through governance mechanisms, Bolivia has the opportunity to transform their energy matrix to a low-carbon emitting fossil fuel. For this reason, it is key for transport researchers to understand the discourse and their sources. If we truly aim to transition to low-carbon, or even zero-carbon fuels, the prevailing discourse and counter-discourse will play a role in how quickly we undergo that
transition. If Bolivia can make that transition, their process could inform other countries who aim to reduce their carbon dioxide emissions.

Engaging with the discourse will be critical in our understanding of energy transitions. Whether in the ‘First World’ or ‘developing’ world, technology will generate new forms of energy or reconfigure the ones that we currently have. Dissecting the language can help researchers learn the power dynamic and evolution of manipulation and control. In Bolivia’s case, the state is focused on using the domestically produced resource at any cost. The drawback to this method is that people who arguably could benefit the most from the exploitation of natural gas are excluded from its transport benefits. The discourse and actions of the Bolivian government are contradictions and help those in advanced political and economic positions. In Santa Cruz, transport innovations will most likely work alongside conventional gasoline and diesel for the foreseeable future and continue feeding the socioeconomic groups that are the furthest removed from the urban poor.
APPENDICES

THE OFFICE OF RESEARCH INTEGRITY AND COMPLIANCE

April 28, 2014

Supervising Investigator: Dr. Matthew Fry
Student Investigator: Jerl McCollum
Department of Geography
University of North Texas

Re: Human Subjects Application No. 14164

Dear Dr. Fry:

As permitted by federal law and regulations governing the use of human subjects in research projects (45 CFR 46), the UNT Institutional Review Board has reviewed your proposed project titled “Bolivia’s Left Turn: Mobility, Equality, and Energy Independence.” The risks inherent in this research are minimal, and the potential benefits to the subject outweigh those risks. The submitted protocol is hereby approved for the use of human subjects in this study. Federal Policy 45 CFR 46.109(e) stipulates that IRB approval is for one year only, April 28, 2014 to April 27, 2015.

Enclosed is the consent document with stamped IRB approval. Please copy and use this form only for your study subjects.

It is your responsibility according to U.S. Department of Health and Human Services regulations to submit annual and terminal progress reports to the IRB for this project. The IRB must also review this project prior to any modifications. If continuing review is not granted before April 27, 2015, IRB approval of this research expires on that date.

Please contact Shelia Bourns, Research Compliance Analyst, at extension 2018 if you wish to make changes or need additional information.

Sincerely,

Patricia L. Kaminski, Ph.D.
Associate Professor
Department of Psychology
Chair, Institutional Review Board

PK/mb

Appendix 1: University of North Texas Human Subjects Application approval.
Focus group participant:

You are being asked to participate in a research study titled: Influence of Vehicular Natural Gas Development on Cruceños Travel Behavior. This research is being conducted by Jerl Levi McCollum under the direction of Dr. Matthew Fry of the Department of Geography at the University of North Texas. This survey is part of Jerl’s master’s thesis. The research is funded by the Graduate Student Travel Support Grant and the Graduate Student Research and Fellowship Support Program through the University of North Texas.

The goal of the study is to assess how natural gas development influences travel behavior and the ability to benefit from transportation in Santa Cruz de la Sierra, Bolivia. A focus group of approximately five people is being conducted in the city. Results from the focus group will be used to demonstrate how vehicular natural gas impacts the everyday lives of urban Bolivians. By conducting this focus group among persons in your community, the researcher is attempting to understand the significance of vehicular natural gas in everyday travel and how the use of vehicular natural gas varies across the city.

You have been selected to participate in this focus group. The focus group will take about 45 minutes to an hour to complete. If you agree to participate, you and other members of the focus group will be asked to answer 12 questions. Your only responsibility is to think through each response, and to be forthcoming and honest. The risk associated with this study is no greater than everyday life. There is no cost, other than your time. There is no compensation or other direct benefits for participating in this study.

The investigator has taken steps to protect your confidentiality and privacy. Your responses to the focus group will remain between you and the investigator. Your name will never be used in association with your responses. Once data from the focus group has been entered into a secure database on the researcher’s personal computer, all transcriptions will be stored in a protected place. The investigator’s signature indicates his intention to guard your anonymity. Responding to the focus group questions indicates your willingness to participate in the study. Although all participants in the focus group will be asked to keep the discussion confidential, there is the risk that others in the focus group may know your identity and may not keep your comments confidential.

If you have any further questions, please use the following contact information:

Jerl McCollum
Department of Geography
University of North Texas
1155 Union Circle #305279
Denton, Texas 76203-5017, USA
Telephone: 1-870-926-4696
Email: jerl.mccollum@unt.edu

Dr. Matthew Fry
Department of Geography
University of North Texas
1155 Union Circle #305279
Denton, Texas 76203-5017, USA
Telephone: 1-940-369-7576
Email: mlfry@unt.edu

Thank you for your time and honest responses to the questions.

Sincerely,

Jeri Levi McCollum

Appendix 2: University of North Texas approved focus group participant waiver.
Survey participant:

You are being asked to participate in a research study titled: Influence of Vehicular Natural Gas Development on Bolivian Households. This research is being conducted by Jerl Levi McCollum under the direction of Dr. Matthew Fry of the Department of Geography at the University of North Texas. This survey is part of Jerl’s master’s thesis. The research is funded by the Graduate Student Travel Support Grant and the Graduate Student Research and Fellowship Support Program through the University of North Texas.

The goal of the study is to assess how natural gas development influences travel behavior and the ability to benefit from transportation in Santa Cruz de la Sierra, Bolivia. A survey of approximately 45 households is being conducted in the city. Results from the survey will be used to demonstrate how vehicular natural gas impacts the everyday lives of urban Bolivians. By conducting this survey among households in your community, the researcher is attempting to understand the significance of vehicular natural gas in everyday travel and how the use of vehicular natural gas varies across the city.

Your household has been randomly selected to participate in this survey. The survey takes about 15 minutes to complete. If you agree to participate, the current head of your household will be asked to answer 16 questions. Your only responsibility is to think through each response, and to be forthcoming and honest. The risk associated with this study is no greater than everyday life. There is no cost, other than your time. There is no compensation or other direct benefits for participating in this study.

The investigator has taken steps to protect your confidentiality and privacy. Your responses to the survey will remain between you and the investigator. Your name will never be used in association with your responses. Once data from the survey has been entered into a secure database on the researcher’s personal computer, all completed forms will be stored in a protected place. The investigator’s signature indicates his intention to guard your anonymity. Responding to this survey indicates your willingness to participate in the study.

If you have any further questions, please use the following contact information:

Jerl McCollum
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Dr. Matthew Fry
Department of Geography
University of North Texas
1155 Union Circle #305279
Denton, Texas 76203-5017, USA
Telephone: 1-940-369-7576
Email: mfry@unt.edu

Thank you for your time and honest responses to the survey questions.

Sincerely,

Jerl Levi McCollum

Appendix 3: University of North Texas approved survey participant waiver.
Participacion a lo grupo focal:

Se le pide a participar en un estudio de investigación titulado: La influencia del gas natural vehicular en el transporte. Esta investigación está siendo realizada por Jeri Levi McCollum bajo la dirección de Matthew Fry, del Departamento de Geografía de la Universidad de North Texas. Esta encuesta es parte de la tesis de maestría de Jeri. La investigación está financiada por la Becas de Viajes para Estudiantes de Posgrado y por el Programa de Apoyo y Becas Universitarias de la Universidad de North Texas.

El objetivo de este estudio es evaluar como el gas natural afecta el comportamiento de transporte y los beneficios en Santa Cruz de la Sierra, Bolivia. Un grupo focal de aproximadamente cinco personas se lleva a cabo en la ciudad. Los resultados de los grupos focales se utilizarán para demostrar cómo el gas natural vehicular impacta la vida cotidiana de los bolivianos urbanos. Mediante la realización de este grupo focal entre las personas de su comunidad, el investigador está tratando de entender el significado de gas natural vehicular en el transporte diario y la forma en que el uso de gas natural vehicular varía en toda la ciudad.

Usted ha sido seleccionado para participar en este grupo focal. El grupo focal tomará alrededor de 45 minutos a una hora en completarse. Si usted acepta participar, a usted y a los otros miembros del grupo focal se les pedirá que conteste 12 preguntas. Su única responsabilidad es responder cada pregunta y ser comunicativo y honesto. El riesgo asociado con este estudio no es mayor que la vida cotidiana. No hay costo alguno, con excepción de su tiempo. No hay compensación u otros beneficios directos por participar en este estudio.

El investigador ha tomado medidas para proteger su confidencialidad y privacidad. Sus respuestas a los grupos focales se mantendrán entre usted y el investigador. Su nombre nunca será utilizado en asociación con sus respuestas. Una vez que los datos del grupo focal han entrado en una base de datos segura en la computadora personal del investigador, todas las transcripciones serán almacenados en un lugar protegido. La firma del investigador indica su intención de proteger su anonimato. Responder a las preguntas del grupo focal indica su voluntad de participar en el estudio. Aunque se les pedirá a todos los participantes del grupo focal que mantengan la discusión confidencial, existe el riesgo de que otras personas en el grupo sepan su identidad y no mantengan sus comentarios confidenciales.

Si tiene alguna duda, por favor utilice la siguiente información de contacto:

Jeri McColllum
Department of Geography
University of North Texas
1155 Union Circle #305279
Denton, Texas 76203-5017, USA
Telephone: 1-870-926-4596
Email: Jeri.McColllum@unt.edu

Dr. Matthew Fry
Department of Geography
University of North Texas
1155 Union Circle #305279
Denton, Texas 76203-5017, USA
Telephone: 1-940-369-7576
Email: mfry@unt.edu

Gracias por su tiempo y honestidad a las preguntas.

Atentamente,

Jeri Levi McColllum

Appendix 4: University of North Texas approved Spanish focus group waiver.
Participacion de la encuesta:

Se le pide a participar en un estudio de investigación titulado: *La influencia del gas natural vehicular en el transporte*. Esta investigación está siendo realizada por Jerl Levi McCollum bajo la dirección de Matthew Fry, del Departamento de Geografía de la Universidad de North Texas. Esta encuesta es parte de la tesis de maestría de Jerl. La investigación está financiada por la Beca de Viajes para Estudiantes de Posgrado y por el Programa de Apoyo y Becas Universitarias de la Universidad de North Texas.

El objetivo de este estudio es evaluar cómo el gas natural afecta el comportamiento de transporte y los beneficios en Santa Cruz de la Sierra, Bolivia. Una encuesta de aproximadamente 45 viviendas es son conducidas en la ciudad. Los resultados de la encuesta serán usados para demostrar cómo el gas natural vehicular impacta el día a día de la población urbana. Un grupo focal de aproximadamente cinco personas se lleva a cabo en la ciudad. Mediante la realización de este grupo focal entre las personas de su comunidad, el investigador está tratando de entender el significado de gas natural vehicular en el transporte diario y la forma en que el uso de gas natural vehicular varía en toda la ciudad.

Usted ha sido seleccionado para participar en esta encuesta. El encuesta tomará alrededor de 15 minutos en completarse. Si usted acepta participar, al jefe del hogar se les pedirá que conteste 16 preguntas. Su única responsabilidad es responder cada pregunta y ser comunicativo y honesto. El riesgo asociado con este estudio no es mayor que la vida cotidiana. No hay costo alguno, con excepción de su tiempo. No hay compensación u otros beneficios directos por participar en este estudio.

El investigador ha tomado medidas para proteger su confidencialidad y privacidad. Sus respuestas a la encuesta se mantendrán entre usted y el investigador. Su nombre nunca será utilizado en asociación con sus respuestas. Una vez que los datos de la encuesta han entrado en una base de datos segura en la computadora personal del investigador, todas las transcripciones serán almacenados en un lugar protegido. La firma del investigador indica su intención de proteger su anonimato. Responder a las preguntas de la encuesta indica su voluntad de participar en el estudio.

Si tiene alguna duda, por favor, utilice la siguiente información de contacto:

**Jarl McCollum**  
Department of Geography  
University of North Texas  
1155 Union Circle #305279  
Denton, Texas 76203-5017, USA  
Telephone: 1-870-926-4696  
Email: jerl.mccollum@unt.edu

**Dr. Matthew Fry**  
Department of Geography  
University of North Texas  
1155 Union Circle #305279  
Denton, Texas 76203-5017, USA  
Telephone: 1-940-369-7576  
Email: mfrv@unt.edu

Gracias por su tiempo y honestidad a las preguntas.

Atentamente,

Jarl Levi McCollum

**APPROVED BY THE UNT IRB**  
FROM 4/28/15 TO 4/27/15

Appendix 5: University of North Texas approved Spanish survey participant waiver.
Cuestionario y Entrevista a Viviendas

Fecha: __________

Distrito: _____ Barrio: _____ Direccion: ________________________________

Nombre: __________________________ Edad: _____ Sexo: Feminino Masculino____

Etnia: Guarani Aymara Quechua Chiquitano Ninguno Otro____________________

Educacion: Basico Secundaria Tecnico Universidad Maestria Doctorado_____

Ocupacion: _________________________

Numero de habitantes: ____________

Tipo de viviendas: Casa Departamento Cuarto(s) Vivienda improvisada____

Materiales exteriores: Ladrillo/Cemento Adobe Piedra Madera Cana Otro_____

Numero de pisos: 1 2 3 4+____

Vivienda tiene bano: Si No____

Vivienda tiene electricidad: Servicio publico Motor propio Panel solar Otro Ninguno____

Habitantes tiene: Radio Televisor Computadora Internet Telefono_____

Clasifique Auto Amigo Micro (#) Taxi Trufi Moto-taxi Otro____________________

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Tiene auto propio? Si No _____

Si no tiene auto, convertiria? Si No _____

Sabe de los subsidios para GNV? Si No____

Si “Sí,” desde cuando? ________

Como supo?

El GNV afecta a su transporte (costo, viajes, modo escogido)? Si No____

Si “Sí,” como?

Mejoras a las politicas GNV

Voto a nacionalizar el GNV? Si No____

Por que?

Appendix 6: Resident questionnaire and semi-structured interview questions.
### Cuestionario En-Transito

**Fecha:** __________

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<th>No</th>
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<td>No</td>
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<tr>
<td>Si “No” a GNV, por qué no?</td>
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| Si no tiene auto, convertiría? | Sí | No |
| Si sabe de los subsidios para GNV? | Sí | No |
| “Sí,” desde cuándo? | ________________ |

| Como supo? | ________________ |

| El GNV afecta a su transporte (costo, viajes, modo escogido)? | Sí | No |
| “Sí,” como? | ________________ |

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**Appendix 7: Transit questionnaire**
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