The Implementation Gap in Responding to Beijing's Air Pollution:

Explanation and Policy Recommendations

by

Feifei Zhang

A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Approved March 2020 by the
Graduate Supervisory Committee:

Douglas Webster, Chair
David Pijawka
Jianming Cai
Larissa Muller

ARIZONA STATE UNIVERSITY

May 2020

ABSTRACT

The lack of in-depth understanding of why policies succeed or fail in implementation puts future policymaking in a situation of having insufficient information to craft effective interventions. Mainstream policy implementation theory is rooted in a democratic institutional setting. Much less empirical research and theory addresses implementation in top-down authoritarian contexts, such as China. This study addresses the research question of how the Chinese governance context affects stakeholder's behavior in combating air pollution, based on the analysis of implementation of three particular air pollution policies: (i) Natural gas / electricity conversion from coal, for winter heating, (ii) Widespread deployment of New Energy Vehicles, and (iii) The shutting down of cement production in northern China during the winter heating period to avoid overlapping pollution emissions from winter heating.

This study identifies flexibility and accountability as two important characteristics of the Chinese governance context, and traces how they affect stakeholder behavior and coalition formation, which in turn impacts policy implementation performance. The case study methodology triangulates analysis of government policy documents, secondary data, and the results of semi-structured key informant interviews.

Findings include: (i) The Chinese government has a very strong implementation capability to pass directives down and scale up, enabling rapid accomplishment of massive goals. It also has the capability to decide how the market should come into play, and to shape public opinion and ignore opposition; (ii) Interventions from the authoritarian government, given China's vast economy and market, and the efficient top-down tiered bureaucratic system, risk distorting the market and the real policy goals during the implementation process; (iii) There tends to be an absence of bottom-up participation and feedback mechanisms; (iv) An effective self-correction mechanism, associated with flexibility and adaptability by a myriad of stakeholders often enables effective policy adjustment.

Policy implications include: (i) Policy implementation concerns need to be integrated into policy design; (ii) More thorough discussion of options is required during policy design; (iii) Better communication channels and instruments are needed to provide feedback from the bottom-up; (iv) On complex policy issues such as air pollution, pilot projects should be carried out before massive adoption of a policy.

For Andrew and Lili

ACKNOWLEDGMENTS

After completing my dissertation, I finally had the chance to write my acknowledgement. During the process of writing my dissertation, I felt such gratitude and appreciation for all the support that I had been receiving, and I often felt the urge to write this acknowledgement ahead of my dissertation. I've refrained until now, but I am happy to finally be able to type this out.

First and foremost, I would like to give a big thank you to my supervisor, Professor Douglas Webster, without whom I would not have been able to complete this research. Of all his students, I think I took up the largest portions of his time. He would actively communicate with me regarding my research progress, design the research with me, and edit my dissertation sentence by sentence. When I say I would not have been able to complete my study without him, I mean it sincerely. I would like to express my gratitude to Professor David Pijawka, who offered his full support and encouragement. He and his wife, Judy, are so kind to me, and they even hosted my wedding at their house. Professor Jianming Cai is my supervisor for my master's at the Chinese Academy of Sciences. He has been supporting me for many years. He is a pivotal person in my life. All the milestones and all the important contacts I have in my life originated from him. I wouldn't have the chance to study in Europe, or get to know the rest of my committee if not for Dr. Cai. When I needed to do my fieldwork in Beijing, he provided me a desk in his office, and many conversations which were so enlightening and helpful to my research. Professor Larissa Muller played an important role in my research. She would call me and talk with me on Skype for hours and hours regarding my research. She is intelligent, funny, and straight to the point. Her instruction in the methodology, and in the building of the theory helped me to build a valid framework for my research. I am deeply grateful for all these valuable assets that I received and learned from every member of my committee.

From the bottom of my heart, I would like to express the utmost gratitude to my family. I am truly lucky to have a completely supportive system. Having a child in the middle of my research was

difficult, but my family afforded me every possible opportunity to succeed. My husband would take our daughter and stay with my parents-in-law for the weekends to give me more time to write. When I needed to do my field study in China, my parents took care of my daughter for five months. I also want to mention my parents-in-law, Pam and Pat, and my sister-in-law, Emily, for always making themselves available for babysitting when I needed time for research. I feel deeply grateful and fortunate to have them as my family.

I would like to give special thanks to all my interviewees, who spent their time with me and shared valuable information and thoughts on my study subjects. I would also like to give my thanks to Zhong Yuezhi from the Chinese Academy of Environmental Planning, Liu Xiaojie from the Geographical Sciences and Natural Resources research, the Chinese Academy of Sciences, Liu Junping from Beijing Urban-rural Economy Information Center, and Xiang Zhen from the Environmental Protection Bureau of Xiacheng District, Hangzhou, Hao Qinglin and Yang Yuejia from Neiqiu county, Hebei province for extending their personal connections and assisting me in arranging the interviews. Thanks to Lv Hongdi, Li Xin, Yu Lei, Cheng Liang and Zhou Jinsong from the Chinese Academy of Environmental Planning for sharing with me their insights on my study subjects and relevant internal materials. Thanks to Lin Jing and her mom for providing me with shelter and for cooking me delicious meals during my field study in Beijing. Thanks to Dennie Oppenheim, Jing Li, Trudy Li Chuleiyi, Vicky Cheng Mengyao, and Shi Yichuan for encouraging me and cheering me up. Without those support I would not have been able to finish this journey.

Finally, I would like to acknowledge the support offered by the School of Geographical Sciences and Urban Planning at ASU during my studies here. I also would like to thank the ASU Child Care service for their help in assisting me with daycare.

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ACRONYMS AND ABBREVIATIONS

APPCAP	Air Pollution Prevent and Control Action Plan
ACI	Actor-Centered Institutionalism
ACF	Advocacy Coalition Framework
AQSIQ	General Administration of Quality Supervision, Inspection and Quarantine
BAC	Beijing Agricultural Commission
BAT	Baidu, Alibaba and Tencent
BAIC Group	Beijing Automotive Industry Holding Co., Ltd.
BEV	Battery Electric Vehicle
BTH	Beijing-Tianjin-Hebei
BTU	British thermal unit
CAEP	Chinese Academy of Environmental Planning
CAFC	Corporate Average Fuel Consumption
CNOOC	China National Offshore Oil Corporation
CPC	Communist Party of China
CPPCC	Chinese People's Political Consultative Conference
DRC	Development and Reform Commissions
EPB	environmental protection bureau
FCV	Fuel Cell Vehicle
GAC	General Administration of Customs
GAC Group	Guangzhou Automobile Group Co., Ltd.
MEE	Ministry of Ecology and Environment
MEP	Ministry of Environmental Protection (former MEE)
MIIT	Ministry of Industry and Information Technology
MHURD	Ministry of Housing and Urban-Rural Development
MoC	Ministry of Commerce

MoF	Ministry of Finance
MoST	Ministry of Science and Technology
NEV	New Energy Vehicle
NDRC	National Development and Reform Commission
NPC	National People's Congress
PHEVs	Plug-in Hybrid Electric Vehicles
R&D	Research and Development
SAIC Motor	Shanghai Automotive Industry Corporation
SC	State Council
SEZ	Special Economic Zone
SOE	State-Owned Enterprises

CHAPTER 1

INTRODUCTION

1.1 Research Context

Policy is an important instrument for combating Beijing's smog. Air pollution has been / is a priority issue, drawing much attention from the general public and from the media, both domestically and internationally, especially after the breakout of the "off the charts" $PM_{2.5}$ levels in January 2013 in Beijing and its surrounding areas. Later in the same year, the Chinese State Council issued the *Air Pollution Prevention and Control Action Plan (2013-2017)* (APPCAP hereafter), which put forward the objectives and strategies to combat air pollution, especially $PM_{2.5}$ and $PM_{10,}$ over the next 5 years and beyond. Meanwhile, intensive actions were carried out,[1] being called the "historically most strict environmental protection measures". In the "two sessions" in 2014, Premier Li Keqiang declared "war against pollution", showing the determination of the central government to tackle the problem. In 2017, the last year of the APPCAP planning period, a series of supplemental plans were launched to facilitate air pollution control.

Those plans are definitely working. By the end of 2017, the objectives specified by the APPCAP had all been achieved. For the Beijing-Tianjin-Hebei region, one of the three metropolitan regions that has the worst air, the $PM_{2.5}$ concentration levels fell from 89.5 μg/m^3 in 2013, to 68 μg/m^3 in 2017, a 24 percent decrease, which exceeded the planned 20 percent decrease by 4 percentage points.[2] Although still at a very high level of pollution compared to WHO standards, which is 10 μg/m^3, Beijing's air has been significantly improved. To keep the momentum of the "winning"

[1] Some of the actions include intensive inspection to enterprises, subsidies to support the substitution of coal to electricity or natural gas in 700 villages, bringing more than 6,000 "scattered, messy and dirty" enterprises under regulation, phasing out 447,000 old vehicles, changing the catalyst for 8,000 taxis, supplying diesel and gas that meet the Beijing VI standards, launching three local standards for heavy duty vehicles, and inspecting 1 million heavy duty vehicles.

[2] Source: Xinhua. (2018-02-01). APPCAA goals all met. Accessed on 2020.01.26 from http://www.xinhuanet.com/2018-02/01/c_1122350409.htm

prospects, in 2018 the “Battle for Blue Sky Action Plan (2018-2021)” was launched, echoing the term “battle” used by premier Li Keqiang in the Report on the Work of the Government on March 5, 2017.[3]

Mid-term evaluations for the APPCAP were published by the state-run think tank, Chinese Academy of Engineering, in 2016. These evaluations used quantitative approaches to conclude that those policies are effective in combating the air pollution, and that a synthetic effect has been achieved.[4] However, apart from calculating the contribution of policy clusters to pollutant emissions reduction, revealed by using regression models, the implementation process of air pollution policy is still significantly understudied, especially with regard to stakeholders’ behavior and how it’s been shaped by China’s political-administrative structure. Can the ends justify the means? And, are the ends really what the means directed? Overlooking the implementation phase is likely to reduce future air pollution policy efficacy. The lack of in-depth understanding of why policies succeed or fail puts future policy-making in a situation of insufficient information to craft effective interventions.

Beijing’s policies and regulations tend to use administrative tools. If not well designed, not only side effects take place, it may even generate opposite outcomes from the policy’s intention. Driving restrictions is one such example. Personal cars are not allowed to be on the road for one day per week. Research in both Beijing and Mexico City show this policy not only encourages people to buy a second car, but also discourages them from phasing out old cars they were planning to phase out, and those old cars generate more pollution than the new ones (Davis, 2008; Xie, 2010). Although the government’s evaluation report connected the improvement of air

[3] “Battle for Blue Sky” was proposed by Premier Li Keqiang in the Report on the Work of the Government on March 5, 2017.

[4] Source: People.cn. (2016-07-07). Experts introduced the evaluation results of the Action Plan: level of every pollutant concentration decreases year by year. Accessed on 2020.01.26 from http://env.people.com.cn/n1/2016/0706/c1010-28529390.html

quality and the traffic situation in the short term with the enforcement of the driving restriction policy, it's plausible that the positive effects are due to other policies that are actually working.

One general policy launched by the central government may result in different outcomes in different political jurisdictions due to their specific situations, such as uneven development levels and unequally distributed resources. For example, in the Beijing-Tianjin-Hebei region, Beijing, as the capital city, invests much more resources to solve its air problems, partly because in Beijing there is a higher ratio of higher educated, higher income people, whose voices calling for a better environment make a difference. In the surrounding Hebei province, where many people are still struggling to earn a living, cement and steel are its pillar industries, and coal consumption is high, so high pollution emission is deemed inevitable.[5] Five cities in Hebei are in the 25 most polluted cities in the WHO database, and all have higher annual average $PM_{2.5}$ concentrations than Beijing. Not only do people breathe worse air there, but also the regional air pollution control actions that have been implemented have triggered serious economic loss and social instability in these areas. Factories are being shut down and workers laid off in trying to meet the goal for 2017 set by the APPCAP. Beijing Municipal Environmental Monitoring Center, regional transport accounts for 28% to 36% of $PM_{2.5}$ concentration in Beijing. The interwoven issues of different economic development levels and uniform air pollution control regulations bring more complexity to policy implementation and impede policy effectiveness. Additionally, every implementation of national policy relies on lower level political jurisdictions to "adjust" national policy to local conditions. The degree of local implementers' discretion is hard to regulate.

China is transitioning from the economy-as-the-priority era to a more balanced development era. With a slowing down of economic growth, and a growing demand for higher quality of life from the public, such as better environmental quality and social services, China needs to figure out a new

[5] Zhang Chun, on Chinadialogue.net. (2013-06-25). Beijing is trapped in its polluted neighborhood. Accessed on 2020.01.26 from https://www.chinadialogue.net/blog/6135-Beijing-is-trapped-in-its-polluted-neighbourhood/ch

developmental path to balance goals including fostering innovation, reducing pollution, eliminating poverty, improving education and health care levels, etc.

Achieving those goals requires adjustment from the economy-as-priority path long in place. However, this new path is unknown. There were no set rules for China's economic miracle – if there were, it was constant experimentation, constant tinkering, constant change, with a recognition that no one-size-fits-all strategy is appropriate for different situations. To explore the new path in achieving more balanced development, it is important to analyze the mechanism of policy implementation in the context of an understanding of China's specific political-administrative context.

1.2 Research Objectives

Given the aforementioned concerns in evaluating Beijing's air pollution policies, this research will focus on the implementation phase of the policy process, which is, as O'Toole (2000) phrased it, "what develops between the establishment of an apparent intention on the part of government to do something, or to stop doing something, and the ultimate impact in the world of action", (p266). The research does not attempt to judge the normative values of the policy, nor does it evaluate if/how the policies affect the air quality improvement. Rather it tries to explain how the policy is implemented, under the political and social context where the implementation takes place.

Policy implementation is influenced by its context, which includes various political, social, cultural, and economic systems and levels of development. The starting point for policy implementation scholars should be to serve the ultimate goal of improving policy (Ingram, 1990). Thus this research probes the factors which impact Beijing's air pollution policy implementation performance, at different levels of administration, and among different stakeholders. In other words, it tries to explain how stakeholders act in policy implementation, and why, in terms of the unique Chinese context. Although my research doesn't necessarily try to be prescriptive, I hope the conceptual framework can be not only explanatory, but also of some value in providing

guidance on anticipating implementation problems. Policy implementation is not simply local implementors' compliance with specific provisions of national policy. I will argue that the interdependency among stakeholders should be considered upfront and incorporated into the decision processes. Most policy-making has focused on secondary aspects, or policy tools (Sabatier, 1988). Lack of stakeholder analysis when the policy is made can cause distortion in implementation. In this thesis, I will diagnose some fundamental issues China has with the policy process, and put forward policy recommendations.

Given the dominance of Western literature in shaping public policy theory and practice, this dissertation also draws on theories derived from implementation studies and frameworks related to stakeholder analysis in Western literature, to establish an approach for better understanding and explaining how and why implementation succeeds or fails in the Chinese context.

Three air pollution policies are selected for the case studies: (i) The "coal to natural gas/ electricity" conversion for winter heating, (ii) Widespread use of the New energy Vehicle, and (iii) Shift of Production, i.e., restrictions in the production schedules of polluting industries, particularly cement. Focus is given to the implementation of these policies in Beijing and its surrounding areas. The three study subject policies target the three major sources of air pollution, i.e., coal burning, automobiles, and industrial production, respectively. The case studies selected is not exhaustive in typology; however, its aim is to shed some light on policy implementation related to air pollution, and provide a study methodology that can be duplicated in studies of other policies.

1.3 Significance

Understanding the factors that have an impact on the implementation performance of Beijing's air pollution policies, contributes to both academic and public realms. Academically, there are significant gaps in studies of environmental policy implementation, particularly in the Chinese context. Unlike policies in areas with relatively little conflict in belief systems, such as health and education, environmental policies have an inherent controversial relationships with economic

development, and depend more on the decision maker's value system, as Ackerman & Hassler (1999) illustrated in the debate over the trade-offs between the EPA's aggressive regulations on coal-fired power plants and the cost to reach environmental goals. In this regard, this study adds three significant cases to the current literature on environmental policy research. Secondly, although the dominant Western literature on public policy theory and practice is context specific, there is no implementation theory that is rooted in and tailored to a non-democratic institutional setting, such as China, or that is not rooted in Western implementation theory. This study fills the gap by adapting Western Implementation theory to China's political-administration setting, recognizing China-specific factors. The goal is to establish a new theory that is both sensitive to, and actionable, in China's unique institutional and cultural context.

The contribution of this research to the public is also two-fold. Firstly, it elaborates stakeholder behavior in policy implementation. This will increase public understanding of public processes and enable them to be engaged, e.g., through social media, in a more informed way. Especially now that China is in a socio-economic transitional period, all levels of governments (central to local) have a more comprehensive agenda that transcends GDP maximization. Critical issues such as environmental protection and social justice are gaining priority. This study will increase public understanding of stakeholder behavior regarding air pollution that can lead to a more informed public. Secondly, given the lack of explicit policy implementation design in current policy decision making, this study's input to environmental policy implementation adds to the understanding of the mechanism under China's political- administrative context, thus helping to integrate implementation into policy design.

1.4 Research Question

This research is about policy implementation. Van Meter, D. S., & Van Horn, C. E. (1975), clarified that the study of policy implementation is not to "measure and explain the ultimate outcomes of governmental policy, but rather to measure and explain what we prefer to call program performance in the policy process, i.e., the degree to which anticipated services are

actually delivered", since "a policy may be implemented effectively, but fail to have a substantial impact because it was ill-conceived, or because of other circumstances" (p448-449). Thus, in this dissertation, the scope of research regarding policy implementation is neither policy making (focusing on what ought to be done), nor the policy outcome (focusing on what is actually being delivered), but on *how* a policy is implemented, and *why* it is being implemented in that way.

Based on this clarification, this research aims to explain air pollution policy implementation performance in the Chinese context, so as to provide guidance on the integration of implementation mechanisms into policy design. To identify the factors which affect air pollution policy implementation, an understanding of stakeholders' motivations and behavior is essential. Thus the overarching research question being asked is:

How does the Chinese governance context affect stakeholder behavior in achieving air pollution abatement outcomes in Beijing?

1.5 Organization of the Dissertation

The dissertation is structured as follows:

Chapter 1 introduces the research context and objectives, the research questions, and discusses the significance of the research.

Chapter 2 reviews the existing literature on stakeholders and coalitions in policy processes, institutional flexibility, and accountability, which are the three components that constitute my conceptual framework. I review Actor-centered Institutionalism, Implementation Theory, Growth Machine, Social Construction theory, Advocacy Coalition Framework, and the Chinese Sustainability Theory, and other relevant analytical frameworks, as well as empirical studies on policy implementation in China. I then identify the knowledge gaps.

Chapter 3 elaborates the conceptual framework that provides the theoretical base and guides the analysis of the three policies in this dissertation, with a brief description of the factors identified in the conceptual framework.

Chapter 4 presents the methodology, including the roadmap, the data collection and analysis methods, and the case study selection process.

In Chapter 5, I apply the analytical framework to the coal to natural gas/electricity conversion policy.

Chapter 6 is an application of the conceptual framework to the New Energy Vehicle Policy.

Chapter 7 analyzes the Shift of Production Policy, using the conceptual framework to explain the policy implementation process and outcome.

Chapter 8 compares the implementation of the three policies and gives some cross-case analysis. It questions the usefulness of the dominant top-down policy approach, and offers an understanding of how different stakeholders' interests alignments and conflicts shape policy implementation. It summarizes the findings of the prior chapters, then offers some suggestions as to how my findings can inform air pollution policy making, so as to take into account the implementation mechanisms in China (and beyond).

CHAPTER 2

LITERATURE REVIEW

This study is concerned with understanding the nature of the actors' behavior in air pollution policy implementation under the Chinese governance context. This review thus identifies literature on 1) *The existing theories and analytical frameworks on stakeholders (dependent variable) in policy studies*, and 2) *Features of the Chinese political-administrative system (independent variable) that impact policy implementation style*. I also include the studies on policies' implementation gap in China with institutional and stakeholder analysis, which are usually interconnected, and the impacting relationship is implicit. This review then points out that a framework for analyzing the impacting relationship of the independent variable on the dependent variable is needed to explain implementation performance of air pollution policy in China. The purpose of this review is twofold: first, to delineate the scope of the research based on the research gaps; second, to underpin the conceptual framework of this study.

2.1 Stakeholder Analysis in Policy Study Analytical Frameworks

Stakeholder analysis is an essential element in policy studies. In O'Toole's (1986) review of 300 studies on implementation, the most common explanatory factors, besides policy characteristics and resources, are about actors, including "multi-actor structure, number of actors, attitudes and perceptions of implementing personnel, [and] alignment of clientele" (p189). Approaches to analyze stakeholders and their relationships are proposed in various analytical frameworks.

Policy networks is an overarching analytical framework that is used to describe, theorize, and prescribe to public management, in terms of the links between government and societal actors in the policy process (Rhodes, 2009). It is an agent of governance which goes beyond the market or hierarchy (Lan & Peng, 2018). It considers policy making as a joint process, in which multiple players jointly make decisions and are dependent on one another in implementation (Hill, 2005; Rhodes & Marsh, 1992), since "no single actor unilaterally has sufficient legal, financial,

organizational and knowledge resources to push through and execute decisions"(de Jong et al., 2016). Thus they enter coalitions. All the above interpretations of policy networks contain the concept of "coalition", and different types of coalitions are defined in different networks.

Rhodes (2009) put the different types of networks along a continuum according to the closeness of the internal relationships. Policy communities is on one end, which have limited number of participants, and the members share similar "ideology, values and broad policy preferences". The interaction involves bargaining between members with resources, to reach a balance of "positive-sum game"; Participating groups are hierarchical, so leaders have the overlook of the members. On the other end stands the issue networks, which involves a large number of participants with different degrees of interests and commitments, that are loosely connected, can be free-forming by groups, government agencies and individuals (Heclo, 1978).

Recent research on policy networks emphasizes resources and knowledge sharing that spans the geographical boundaries and different levels of governments (Lan & Peng, 2018). It has a focus on policy intervention involving large numbers of actors, loci and layers, and across multiple jurisdictions (Conteh, 2011). Elmore (1983) explains that actors at different political and administrative levels control different implements, i.e., policy measures and instruments. Each set of implements has a limited range of effectiveness. The content of policy at any given level of the system is a function of the implements people control at that level and the effects they are trying to produce at other levels. The outcomes of policy are a function of how well implements at different levels mesh together to produce a result.

An Advocacy Coalition Framework (ACF) is an effort which conceptualizes the policy learning and policy change within a policy network (Sabatier,1988). In ACF, the coalition is defined as "people from various organizations who share a set of normative and causal beliefs and who often act in concert", to "seeks power to translate its core beliefs into policy". The advocacy coalition is formed because of the common 'belief system' (Sabatier, 1988, p148).

The ACF recognizes three layers in the belief system, i.e., Deep Core Beliefs, which are fundamental normative and ontological axioms which define a person's "underlying personal philosophy", and are the least susceptible to change, such as how we should rank values such as freedom and security (Sabatier, 1998); Policy Core Beliefs, concern the basic strategies for achieving deep core normative axioms in the policy subsystem, such as the proper balance between government and market (P. Sabatier & Jenkins-Smith, 1993); and Secondary Aspects, which are instrumental decisions and information searches necessary to implement policy core beliefs (Sabatier, 1988). In light of new strategic considerations, new information, or scientific evidence, secondary aspects may change over time within a coalition. Policies reflect the belief system of the dominant coalition in a subsystem (P. Sabatier & Jenkins-Smith, 1993).

The ACF model has been applied to a considerable number of cases, in particular energy, environmental or social policy disputes (Cerna, 2013). In most subsystems, the number of politically-significant advocacy coalitions will be quite small. In most cases, there will be 2--4 important coalitions (Sabatier, 1988). For example, the American air pollution subsystem in the 1970s had two advocacy coalitions, the "Clean Air Coalition", who favored a command and control approach, and the "Economic Feasibility Coalition", who preferred economic incentives (Sabatier, 1988).

While Sabatier (1988) claims beliefs are more inclusive and more verifiable in defining coalitions, critics argue that shared beliefs aren't sufficient condition to glue a coalition together. Coalitions might also emerge in the absence of shared value if actors have common interests and depend on each other (Fenger and Klok, 2001). Cooperation does not imply consensus over values and beliefs, and the benefits realized by participants may be purposive as well as material (Stone, 1993). For example, the low-sulfur coal companies in the western United States joined the Clean Air Coalition and sided with environmentalists against midwestern higher-sulfur coal suppliers out of self-interest (Ackerman and Hassler, 1981).

The Urban regime framework provides another analytical prism to assess stakeholders. It “views power as fragmented and regimes as the collaborative arrangements through which local governments and private actors assemble the capacity to govern” (Mossberger & Stoker, 2001, p812). The governing coalition is a way of regime making to bring together various elements of a community and the different resources (Stone, 1989).

Urban Growth Machine (Molotch, 1976) is a governance coalition comprised by local actors and organizations who share an interest in local growth, particularly economic and demographic, and its purported benefits. The members of growth coalitions include landowners and “land related interests”, including real estate agents, lawyers, major banks, utilities, department stores and local newspapers, through local government, to promote the growth of the city. The growth coalition is a typical development regime under Stone’s categorization. It is formed based on, and benefits from, the growth of a city, via mobilizing local government to develop the local business climate so as to attract investment and push the social or environmental costs of its activities to the public.

Stone (1993) expanded on the growth machine. He defined four types of regimes, namely: (i) The maintenance regime, which focus on provision of routine services; (ii) The development regimes, which are concerned with changing land use to promote growth – this regime role requires coordination among a small number of elites, and works best when the public is passive; (iii) The middle-class progressive regime, which focus on measures such as environmental protection, historic preservation, and affordable housing – in this type of regime the government-business relationship is not largely voluntary, a mix of activities and restriction apply to elites, development is encouraged or at least not prevented, and citizen participation is useful; and (iv) The lower-class progressive regime, which is concern with “expanding opportunities through human investment policies and widened access to employment and ownership”, such as policies

targeting enriched education and job training, improved transportation access, and enlarged opportunities for business and home ownership.

The interrelation between the two coalitions in air pollution policy in the US, i.e., the “Clean Air Coalition” and the “Economic Feasibility Coalition”, is a middle-class progressive regime, the third type of regimes defined by Stone (1993). It is difficult to achieve, partly because it is catalyzed by some degree of coercion or regulation to businesses rather than voluntary cooperation, and business is still a key participant in governing coalitions (Stone, 1993). The middle-class progressive regime tends to align best with the environmental issues being talked about in this dissertation.

The Urban Regime framework has a focus on the internal dynamics of coalition building, especially public-private collaboration (Mossberger & Stoker, 2001), but it falls short in explaining policy change, since it believes coalitions tend to stabilize because regimes structure resources and establish patterns of interaction, and members form a balanced power structure (Orr & Stoker, 1994). But policy change takes place, and the coalition is dynamic in responding. Take the environmental protection subsystem in the US for instance, it went through major changes in the last century. In the 1960s, the authority to control air quality gradually transferred from local to state and federal levels (P. A. Sabatier, 1988). After the biochemist Arie Haagen-Smit in the late 1950s discovered that primary components of Los Angeles’ smog was associated with automobile exhaust, this science was accepted by local agencies (and later the State and Federal Government), and they redirected their attention toward automobiles (James N. Pitts & Stephens, 1978). California legislated the first anti-smog controls on cars by the 1960s; Congress enacted the first Clean Air Act in 1963, and called for the first national emissions standards for cars two years later; the federal government sponsored research on the health effects of various pollutants. All these changes in policy altered the balance of power in several local and state subsystems (P. A. Sabatier, 1988). The institutional and policy landscape changed again in the early 1980s, when the political philosophy of Reagan administration brought broad-scale retreat

from government intervention in the economy and more reliance on market-based policy instruments (Saetren, 2005). As a part of economic policy, environmental regulations loosened up, and changed from a command and control instruments to a more efficiency-oriented economic instruments model (P. A. Sabatier, 1988). Linked to this core aspect change, state–society relations have changed from unilateral and hierarchical to more reciprocal and less hierarchical (Saetren, 2005).

Besides emphasizing internal interaction within a subsystem, Regime Theory and ACF also mentioned the impact of external factors on the coalition's internal interaction among members (Dowding, 2001; P. A. Sabatier, 1988). As to Regime Theory, the context constrains the process of coalition formation and policy implementation; local market and democratic conditions are the two context variables that influence bargaining and resource mobilization (Dowding, 2001). As to ACF, external events such as macro-economic conditions or the rise of a new systemic governing coalition can change the core aspects of a coalition's belief systems (P. A. Sabatier, 1988). The external impact also can be from other subsystems. Subsystems are not completely autonomous. Actually, the decisions and impacts from other policy sectors are one of the principal dynamic elements affecting specific subsystems (Sabatier, 1988).

Heclo (1974) listed two types of factors that cause policy change: internal factors, i.e., the competition and cooperation for better policy solutions within a policy community through strategic interaction of people; and external factors, such as large scale social, economic, and political changes. While acknowledging that the wider policy environment, including political, economic, cultural, technological and other factors, influences actors and their preferences, Actor-Centered Institutionalism (ACI) argues that the institutional environment has a greater influence on the "perceptions, preferences, and capabilities" of individual and composite actors, and on their "modes of interaction", than individual or group-based interactions (Scharpf, 1997). Institution here is defined as the "systems of rules that structure the courses of actions that a set of actors may choose" (Scharpf, 1997). It includes the formal legal rules and social norms that

actors will generally respect (Lieshout, 1991). Departing from this, ACI seeks explanations for policy and coalition change from the interactions among actors (proximate cause) whose behavior is shaped by the characteristics of the institutional settings (remote cause) (Scharpf, 1997). In one subsystem, the same group of people will interact very differently depending on whether they are within a democratic system, or under a hierarchical administration (Lieshout, 1991), since institutional context structures actors' disposal of resources and influences their orientations (Scharpf, 1997).

To sum up, the sizes, boundaries, composition of participants, and the basis for the formation and sustaining of a coalition varies across different theoretical frameworks, depending on the perspectives of the analysis. The different strands of policy networks cover a wide range of coalitions. They do well in explaining the interwoven nature of stakeholders, but lack the capability of explaining the dynamics of the coalitions. Regimes provide theoretical ground for understanding stakeholder interactions. The development regime is applicable to China's growth mode for the three decades after the reform and open up in late 1970s. While this regime still has its momentum, many cities have been working on transitioning to progressive regimes. However, in this transition, the strictness of implementing environmental policies fluctuate based on the economic prospects. The ACF provides a framework to explain such kind of policy change, through interaction between advocacy coalitions.

Although the focus may differ, one thing in common among analytical frameworks based on an embedded coalition notion is that they are developed under, and extracted from, a democratic context. China has a different administrative structure and institutional setting. Environmental issues add a layer of complexity since they cut across jurisdictional boundaries (which creates horizontal interaction among local governments) and administrative tiers (which requires vertical interaction) of governments. Given those complexities, coalitions play an important role in the policy process in China, yet are usually underestimated in the policy design and implementation. Due to the lack of theoretical base on coalition structures and dynamics that is tailored to China's

environmental protection subsystem, when it comes to explaining the policy implementation outcome, analysts tend to overemphasize a rational, technocratic planning mode while underemphasizing interrelationships among actors (de Jong et al, 2016).

2.2 Chinese Governance Context

2.2.1 The Stakeholder perspective in the study of air pollution policy implementation in China

The air pollution policy coalition in China is comprised of government and private sector actors. For government actors, leadership is considered the most important factor in implementing the government's agenda through policy implementation. The "cooking of ideas" happens within a very small group of people, and under the control of top leaders (X. Zhou, 2011). This mechanism is replicated at different levels of government. At the central government level, it sets the tone of the beliefs that all the stakeholders have to adopt. For instance, the introduction of the concept "eco-civilization" by Xi Jinping when he came into power in 2013 has become a flagship slogan in guiding the development of China. His claim that "green mountains are gold and treasure mountains" has now been widely spread by the various levels of governments and the public. "Eco-civilization" thought is one step further in emphasizing the importance of environmental quality, compared to China's previous development models.

Ouyang (2008) used the "dual agents" model to explain local officials' deviance in the implementation of environmental policy. Local officials are meant to represent the state and society in combating pollution, but, without oversight or constraints, often become agents of the law-breakers instead, engaging in an alliance with polluters where they use the threat of legal powers to extract benefits from them. In other words, coalitions of local officials may "capture" policies. Ouyang pointed out that social issues that heavily rely on local enforcement, such as food security, local environmental management, are particularly prone to the "dual agents" typology. Under this condition, the stronger the legislation, the more bargaining power local officials gain over businesses, power which can be used and play out in different ways.

Economically, while strategic industries such as natural resources and utilities still remain in the grasp of state-owned enterprises (SOEs), other sectors are more marketized and increasingly integrated with the global economy (Naughton & Tsai, 2015). Some studies ascribe the implementation failure to big SOEs' defiance of environmental regulation. According to Eaton and Kostka (2017), just six SOE firms in the electricity generation and oil and gas industries – four of the main electricity generation firms, Guodian, Huadian, Huaneng and Datang; and the two major oil and gas SOEs, Sinopec and CNPC – account for 62 per cent of all 2,370 reported violations (2004 - 2016); among the reported incidents and type of environmental non-compliance, air pollution accounts for 60 per cent of all violations.

Private businesses often sacrifice the environment in pursuit of profit primarily because economic structures force them to do so, often explained by the razor thin profit margins of Chinese firms both domestically and globally, forcing these firms to exploit the environment. An article in Chinadialogue.net depicts the rational of this chain effect:

"The global economy squeezes the profits of Chinese firms, while domestically almost all the sectors where large profits can easily be made – finance, energy, communications, transport – are dominated by state-owned firms. China's numerous private businesses are pushed into a limited number of industries, leading to excessive and destructive competition. With slim profits, it is natural that companies sacrifice the environment to cut costs." [6]

2.2.2 Flexibility and adaptation in China's political administrative system

The Chinese institutional system has a remarkable level of flexibility (Heilmann, 2008; Naughton, 2010). This flexibility is rooted in two unique features of China's administrative system: (i) An authoritarian central government which controls concentrated resources, which explains its

[6] Tang Hao. China's street protests won't change failing system. In Chinadialogue.net. https://www.chinadialogue.net/article/show/single/en/5660-China-s-street-protests-won-t-change-failing-system. Accessed on Dec 5 2017.

capability to make longer term development plans and try out alternative approaches without a breakdown of the political order (Naughton, 2010; Heilmann, 2016); and (ii) A well-structured hierarchical cadre system with a relatively low institutionalization level, which provides room for local adaptation and innovation (Mei & Wang, 2017; Shirk, 1993).

Different from Weber's (1964) bureaucracy, which is an organized hierarchy based on a legal-rational institution, the Chinese bureaucracy is a combination of two parallel but integral parts of one system (Kuhn, 1987). One is the increasingly institutionalized formal structure, such as the cadre recruiting system and policy procedures; and the other one is the widespread informal rules, such as individual networks and negotiations (Heilmann, 2016; Ling & Naughton, 2016; Shirk, 1993).

Studies show the formal organizational design and policy process created a bureaucratic environment in which flexibility is inevitable (Anna et al., 2015). Ling & Naughton (2016) delineate policy process in China into four phases: (i) The policy fermentation, where top leaders lay out agendas or give hints about policies they intend to pursue; (ii) Policy formulation, where interested parties inside the Communist Party of China (CPC) and government, and independent experts, generate structured consensus and give the policy legitimacy; (iii) Policy specification, where the guideline policy documents developed in the policy formulation stage are handed off to bureaucrats to convert into manageable and routine tasks, including responsibility and budget specification; and the last is (iv) Policy implementation in the real world at the local level. One unique feature in this process, as Ling & Naughton (2016) stated, is that the policy specification, including bargaining over trade-offs and arguing over implementation mechanisms, takes place in the bureaucracy, while this procedure would be done in the legislature in the United States as part of "making policy". This procedure gives the implementing bureaucratic agencies discretion in their choice of instruments, an opportunity to enhance their control and access to resources.

While policy decisions are made at the top, at the local level, cadres have to obey directives from the upper levels, the broad-ranging powers of the local leadership group, in particular the Party Secretary and the mayor, which give them substantial maneuvering space to shape the implementation of policies at the local level (Anna et al., 2015; Eaton & Kostka, 2017).

Given the flexibility embedded in the formal bureaucratic system, informal argument occurs when bureaucratic tasks are being carrying out; in contrast to official procedures, the adaptive use of informal devices, realized through social relations can reduce the internal conflict during reform and increase the probability of success of a policy (Xu, 2003; X. Zhou, 2010). The low institutionalization level which was judged as a feature of incomplete reform was later viewed as a unique advantage for China to implement a gradual, incremental, and low-cost reform (Shirk, 1993). But with the trend toward greater institutionalization of the bureaucracy, the scope for decentralized policy entrepreneurship becomes more limited (Ling & Naughton, 2016). Throughout the policy phases, ordinary citizens have little voice in implementation, let alone a share in decision making about the system (Burns & Zhiren, 2010).

Heilmann finds a connection between flexibility and local capacity, and contends that flexibility at the local level is very much hinged on the capacity for local adaptation, including motivated and capable local leadership, and openness to new policy ideas (Heilmann, 2016). Formal and informal institutions facilitated adaptive capacity at the local level, which enables cadres to experiment with a broad spectrum of options in both political and economic systems (Ahlers et al., 2015).

Two unique phenomena in policy implementation in China can be explained by the flexibility and adaptability of Chinese institutions at the central and local level.

The first one is policy experimentation. Many scholars have highlighted the essential role of decentralized experimentation in generating institutional and policy innovations to adapt to a

rapidly changing economic environment in China's Party-state context (Xue & Zhong, 2012). Heilmann (2008) describe the experimentation approach as "purposeful and coordinated activity geared to produce novel policy options". Many studies on China's reform mentioned this phenomenon in explaining China's development miracle since the late 1970s (Heilmann, 2008; Mukand & Rodrik, 2005; Lim, 2017). The central government gave generous subsidies and discretionary powers to jurisdictions that are selected as official experimental venues to try out new policy solutions (Heilmann, 2008). Under Deng's "wading across the river by feeling the stones" philosophy, selected localities were given significant autonomous power to explore paths to growth. The most prominent example would be the establishment of Special Economic Zones (SEZs). Shenzhen, as one of the four initial SEZs, has grown from a little fishing village into one of the innovation hubs of the world (Hardill, 1986). Following which, from the early 1990s to early 2000s, countless decentralized initiatives and experiments took place to promote the economy in China's cities, counties, townships, and villages (Heilmann, 2016; Heilmann et al., 2008; F. Zhou, 2009). Under the national macroeconomic context of economic liberalization, localities have exhibited remarkable diversity in their developmental patterns and capacity for institutional adaptation (Shen & Tsai, 2016). Various successful cases have sprung up, such as the Southern Jiangsu model, the Zhejiang model, and the Shenzhen model.

Since 2000, many of the instruments that promoted growth, such as government investments, export orientation, regulatory flexibility, and informal networks have started to show diminishing effects, while pressure on the government over other issues like environmental degradation and social injustice has increased (Heilmann, 2016). Being aware of the cost of "growth as the top priority", the central government encourages municipalities to experiment with initiatives that have more diverse objectives. Hangzhou, for example, prioritizes environmental protection and aims to build a model for China's sustainability endeavor (Bell, 2015). In this process, the CPC forged a broad coalition to support the restructuring of the economy, through government intervention in promoting technological innovation, new strategic industries, low carbon development and stimulating domestic demand.

Top-down experimentation based on selected localities is a more cautious approach enabling gradual institutional change, which minimizes beforehand political resistance and political risks, accumulates practical knowledge, and ensures that successful trials can be replicated elsewhere in China; in the case of bottom-up policy innovation, reformist policymakers are eager to bolster their political standing by bringing to the attention of upper levels of government locally produced successful policies (Heilmann et al., 2008; Xu, 2003). The application of the experimentation approach shows how adapting programs to local natural and social conditions can help to motivate change and sustain the implementation of new institutions (S. Cao, 2012).

The second phenomenon is campaign style policy implementation. This approach uses top-down campaigns to mobilize resources to pursue policy goals or accomplish a certain mission outside the routinized institution (X. Zhou, 2012). Feng (2011) contends that the prevalence of campaign-style governance in China is due to three reasons: firstly, (i) The government is ambitious on policy implementation, because it has a sense of mission and/or is stressed by legitimacy issues; (ii) The government can't reach its policy goals through institutionalized and routinized measure due to low management capacity, thus it has to resort to a more a radical approach; (iii) The government is highly authoritarian, and thus doesn't need to be approved by the public, and can expect not to be opposed by the society for its radical implementation approaches. X. Zhou (2012) disagrees with this non-routinization claim. Instead, he argues that the campaign style implementation mechanism is rooted in stable institutions. The dual governance model, i.e., "routine power" and "arbitrary power" co-exist (Kuhn, 1987). The logic behind the campaign style implementation is that different regional situations require flexibility in implementation, but flexibility can induce policy distortion, reduce the implementation efficacy, and aggravate distrust between central and local governments. Campaign style implementation is a way to counteract the constraints and inertia in the formal hierarchy system (Zhou, 2012).

This institutional flexibility in China's authoritarian system has an innate advantage when it comes to policies resulting in gains and losses by major interests, such as SOE reform, hukou policy,

land reform, and foreign policy, e.g., the Asian Infrastructure Investment Bank (AIIB) and Road and Belt Initiative (RBI) (Xinhua, 2015). Bell (2015) and Calcagno & Escaleras (2007) argue that in democratic systems, party alternation may alter the government and budget priorities and cause policy change, which means decision makers may have less incentive to experiment and innovate, and skip long-term planning for the sake of short term outputs. Shirk (1993) suggests that the political preconditions for dynamic transformation from plan to market are an authoritarian government and institutional flexibility, based on the Chinese and Soviet reform experiences.

Authoritarian government and flexibility can generate negative outcomes. Firstly, local experimenters tend to overstate the positive results of pilot projects in their jurisdictions; and central policymakers may also set up fake models which yield wasteful and unsustainable policies (Heilmann, 2008). Secondly, since the central political authorities decide what works and what doesn't, they often lack the motivation to do political battle on behalf of innovations that threaten powerful groups (Bell, 2015). Thirdly, there is an increasing distance between policy-making and policy implementation in the decision-making process (Zhou, 2010). Combined with the low institutionalization level in China's bureaucracy, resulting in considerable residual power accruing to human / social networks, selective implementation at the local level occurs. Policies with minor redistribution of costs and benefits to stakeholder interest groups and requiring minor procedural changes are easier to carry out; innovative, complex policies, and those that will result in major redistribution of benefits and costs to key interests are hard to implement (Ran, 2015). The central government is unable to correct such policy distortion, because of the conflict between its indirect management tools and the multiple governance goals (Mei, 2009). When this selective implementation encounters a governance system which lacks thorough checks and balances, it gives local leaders the opportunity to shirk on unpopular initiatives (O'Brien et al, 1999), as suggested by the popular Chinese saying: "From above there are imposed policies, and from below there are evading strategies" (X. Zhou, 2010).

2.2.3 Accountability

Unlike in constitutional democracies, where government officials are accountable to their electorate, China's hierarchical administrative system is characterized by upwards accountability (Fukuyama, 2016). In China's system, the national (central state) government has a high capacity to mobilize local governments to implement its policies (Anna et al., 2015; Heilmann, 2008). This apparatus of mobilization is realized through the CPC being strategically located at each level of government, even down to the neighborhood. Policies and initiatives of the party can be translated into action across the depth and breadth of the society (Duara, 2010).

There has been considerable change in social and economic conditions since the reform and open up, and mobilization to the general society has been limited (Yang, 2012). Performance evaluation has been used as a tool to mobilize local officials in an increasingly institutionalized political - administrative system (Jing et al., 2015; Ling & Naughton, 2016). Performance targets are imposed by superiors to subordinate officials, who are under immense pressure to fulfil them because their careers and economic well-being are mainly determined by the higher authorities (Rong et al., 1998). To maintain this upward accountability, competition pressures are often intentionally created by the central government through applying uniform evaluation criteria to local governments (Jing et al., 2015). F. Zhou (2009) used "tournament system" among provinces and cities to describe the competition, and scholars describe this mechanism as the top-down "pressurized system" (Rong et al., 1998).

The biggest problem about the "tournament system" is that it doesn't represent the preferences of local residents. GDP growth is an appropriate and effective indicator in the early stage of economic development during the transition to a market economy, when increase in income is most people's biggest need. However, after income reaches a certain level, residents' needs are more diverse. How to set appropriate evaluation indicators to encourage local officials to implement policy to fulfill more diverse needs of society becomes a challenge (L. Zhou, 2007) .

Another problem is that this competition may cause local states to only focus on the performance in their territory, which undercuts cooperation with other jurisdictions in the region. Economically It is shown in local protectionism and redundant projects. In the environmental field, it makes the transboundary pollution hard to solve (Burns & Zhiren, 2010; L. Zhou, 2007).

Since the reform of the revenue-sharing system in 1994, the center has decentralized administrative responsibilities such as education, healthcare, and environmental protection. This institutional arrangement, together with cadre performance evaluation, decentralized the responsibility of the CPC down to the local level, and stimulated local officials to take charge of those issues in their jurisdiction (Jing et al., 2015). Local cadre performance evaluation is the most powerful institutional tool for securing effective policy implementation (Anna et al., 2015). Up until the early 2010s, although national leaders have addressed China's environmental issues, local leaders, who bear responsibility for interpreting and carrying out environmental policies, typically are not strongly incentivized to take on the difficult business of changing lanes from a growth-at-any-cost model to a resource-efficient and sustainable path (Eaton & Kostka, 2017). That's because the centralized political system makes the promotion criteria for local chiefs slant heavily to local chiefs' achievements in promoting local economic growth (Mei, 2009).

In recent years, except for economic growth, sustainability and social stability have been two very important aspects of the government's evaluation and promotion indicators (Wang 2013; Zheng et al. 2014). The central government attempts to influence the mix and priority of local activities through adjusting the evaluation criteria, which includes putting more weight on people's satisfaction and social stability (F. Zhou, 2009; L. Zhou, 2007). The change of evaluation standards works as a strong vehicle to drive local government transition from an economic-driven development model to a more balanced progressive regime. Empirical studies show that increased concern over environmental pollution from both the public and the top-level leaders incentivize urban leaders to tackle pollution issues (Shen & Tsai, 2016).

Increasingly formalized performance evaluation brought two types of consequences. On one hand, local officials have reacted by focusing more and more on clearly stated, quantifiable tasks. Some scholars believe China's accountability system reconciles local governments' interests with the central government's policy objectives, and increases overall institutional capacity and local adaptiveness (Anna et al., 2015). One example of more institutionalized accountability is the establishment of the "lifelong accountability system". The central authorities periodically rotate local officials to enhance their control of the bureaucracy (Eaton & Kostka, 2017). Only a small minority of leading officials actually serve out the prescribed five-years term in full in one location. The majority move on to the next position within three to four years (Eaton and Kostka, 2014). The high turnover of leading cadres at the local level may hinder state-led greening growth initiatives. Since the effect of environmental interventions are time lagged, costs are incurred in the short term but benefits only materialize in the longer term. Given their short tenure, local leaders with short time horizons are likely to choose the path of least resistance in selecting quick, low-quality approaches to the implementation of environmental policies, and leave complex environmental problems to their successors (Ran, 2015). Now, under the "lifelong accountability system", the liability of leading cadres of the party and government for damage to the ecological environment follows them after they have left positions in one locale to work in another (Zhang et al., 2016).

On the other hand, sometimes overambitious quantifiable evaluation standards from superior levels puts intense pressure on the subordinate governments and their staff, incentivizing them to pursue policy goals that require extrabudgetary resources. If the subordinate government couldn't fulfil their tasks, their career will be negatively impacted. To cope with such uncertainty, they react by developing abnormal coping strategies, such as collusion and social network development, which have resulted in distortion in achieving official policy goals (Burns & Zhiren, 2010; X. Zhou, 2010). Thus the accountability system is often referred to by China scholars as one of the main reasons for goal displacement, selective implementation and indolence (Anna et al., 2015). This

authoritarian system is more effective in producing policy outputs than outcomes (Burns & Zhiren, 2010; Gilley, 2012).

This accountability system also poses a heavy burden on the street level implementors. Local governments, especially town and township governments, have to deal with enormous tasks from the upper levels. They have limited personnel and various work assigned by upper level government departments, such as anti-corruption, product safety, environmental protection, education, poverty reduction, propaganda, etc. In order to report progress re the status of these tasks, town and township governments can only do the job at the lowest cost in the shortest time (Zhao, 2006). On one hand, to avoid punishment, each level of government adds more tasks to lower level governments, which becomes excessive when it comes down to the actual implementing level, and sometimes it becomes a burden to, instead of welfare enhancement, to policy recipients; on the other hand, due to the lack of resources and capacity, in implementing those policies, some tasks are just simplified as number games (gaming the system).

Some scholars argue that since the central authorities can take a longer-term view of the nation's interest than politicians in democratic countries, the Chinese system is in fact more genuinely accountable (Fukuyama, 2016). There are some successful cases that tend to corroborate this position. Zhou (2011) has reviewed the Chinese family planning policy and called it an "exceptional successful case where policy is well implemented at the local level under an authoritarian institution". The main reasons for successes point to the design of the implementation structure, which include: (i) In the bureaucracy, staff are established in each level of government; (ii) Quantitative targets are distributed level to level downward; (iii) Powerful incentives and perverse incentives are in place, e.g., the veto[7] for government officials if a target isn't met; (iv) Very intensive inspection; and (v) large scale propaganda.

[7] One-vote veto means, in the Chinese Local Government Leading Cadres' Performance Evaluation system, when certain tasks are not achieved, the performance is viewed as "fail". Family Planning target is one example, and it can affect the career of the leading cadre very negatively.

Flexibility and accountability are two salient features of the Chinese institution. Both are rooted in an authoritarian central government, and a hierarchical bureaucracy, where formal rules and procedures and informal social networks and local collusion co-exist. The most fundamental feature of China's institutional system is that the top leaders make all important policy decisions, and choose the implementing agencies (Ling & Naughton, 2016). An inevitable consequence of this arrangement is that the policy made at the top is uniform, thus it tends to be less compatible with various local conditions. The more specific the quantifiable evaluation criteria, the more implementation may depart from the original policy design. Thus flexibility is an indispensable mechanism in implementation (X. Zhou, 2010). The authoritarian central government can make institutional and organizational adjustments and allow local experimentation within a certain scope, without breaking political stability. Flexibility and accountability work together to reach a mutual counterbalance and make China's political-administration system resilient, and work towards the political ideal that informs China's administration system reform, namely "vertical democratic meritocracy," which has open democratic elections at the local level, meritocratic standards for top national leaders, and experimentation in the middle (Bell, 2015).

2.3 Research Gaps

The stakeholder analytical frameworks mainly originate from study of democratic systems. When it comes to analyzing how China's institutional factors affect implementation, many of the studies are conducted using Western theories. There's a lack of theory on stakeholder or stakeholder coalitions tailored to China's unique institutional context, especially ones that can be applied to the environmental policy subsystem.

Empirical study on policy implementation in China has depicted the institutional characteristics and different actors' performance, which help us to understand the predicament in implementation, but the interplay among stakeholders and how the institution impacts this interaction doesn't get enough attention. There is a lack of a governance perspective in

stakeholder analysis. The motives and interests of stakeholders are neglected; the complexity of participation by different actors in policy implementation is underestimated; which actors have the resources required for policy implementation is not taken into account (de Jong et al., 2016). In addition, stakeholder and the dynamic among coalitions change at different stages of implementation. Studies on the causes behind this transition is lacking.

Current literature on Chinese institutions are concentrated on how it shapes the economic reform field, but there is lack of empirical study of the environmental policy subsystem. The situational context as well as beliefs and priorities of implementing agents differ across policy areas and systems, especially since environmental policy is within the progressive regime, which calls for a different paradigm than in the development regime.

Existing study of Beijing's air pollution policy tends to explain the relationship between a specific policy and its outcome and/or impact; but studies that look at the implementation process and answer what went wrong, or what has been done right are rare. There is a need for research that enables enhanced implementation design such that outcomes are, if not predictable, at least more understandable. With central-local governments, relevant ministries, and big SOEs geographically close, Beijing should provide an interesting venue for studying power relations and bargaining process, regular enforcement and campaigns, in the air pollution abatement implementation process.

CHAPTER 3

CONCEPTUAL FRAMEWORK

3.1 The Conceptual Framework

In the research question, the independent variable is the features of Chinese governance context, while the dependent variable is the stakeholder behavior in the implementation of air pollution policy. To understand the relationship between these two, I created an interconnected structure concept graphic, which presents a strategy for analysis (Figure 3.1). Based on the literature review in Chapter 2 on stakeholder coalitions, regimes, and the Chinese governance context, there are two independent variables that I determined most relevant and played out differently in the Chinese governance context: accountability and institutional flexibility. These two interconnected characteristics influence the behavior of the stakeholders in the policy network, and in turn influence coalition formation. If an environmental policy is to be well implemented, it needs adjustability in the policy making phase, adaptability in local implementation, alignment of goals of the key stakeholders, and motivation from the leadership.

Stakeholders are the core of the analysis. They can be organizations or individuals, government or private sector actors. The analysis of stakeholder includes who are they, how they behave, and how do they interact, their power dynamics, dependency of one towards another or mutual, and power shifts. These perspectives of stakeholder analysis are discussed within the coalition connotation. Given that the major implementors of the air pollution policy in China are the public sector actors, including governments at all levels, and SOEs, the stakeholder analysis in this research focuses on those public sector actors.

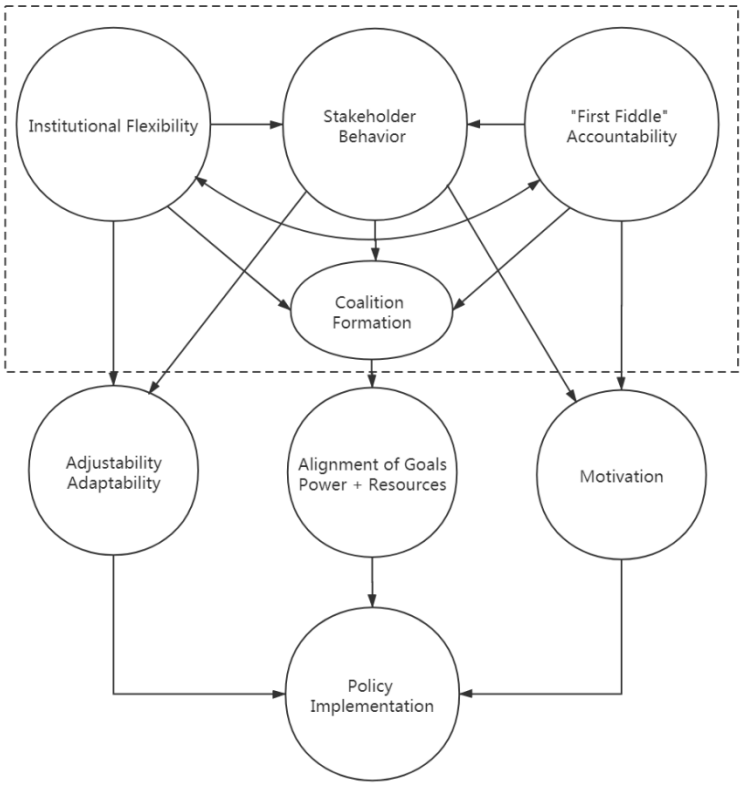

Figure 3. 1 Conceptual framework

Source: The Author.

Regarding the Chinese governance context, while it is very broad and thus difficult to comprehend, my focus is on how flexibility/adaptability and accountability play out differently under the Chinese context. Since these two characters are about the political-administrative systems, the focus of this study is on how these two characters impact the government sector stakeholders' behavior in formulating air pollution policy and shaping the policy implementation performance. The behavior of the other stakeholders, including the public (the residents and the consumers), the third sector actors (NGOs), and the private sector actors (including private enterprises in various industries), are largely influenced by how the government sector actors implement the policy. Their behavior is analyzed based on how the government sector actors behave, and is discussed as a part of the coalition formation.

3.2 Stakeholder Coalition Formation

China's five-level hierarchical administration, from the top, consists of: the national level; the provincial/municipal/autonomous regional level government; the prefectural/municipal level government; the county-level government; and the town/township government. In the implementation of national policy, the provincial level governments pass down the documents and distribute the tasks to its subordinate municipal/county governments; then the municipal/county governments in turn pass the tasks down to town/township governments. At the bottom of the hierarchy, the "squeezed" local cadres are the ones dealing with the ground level implementation. The policy process is dominated by different actors at each clearly divided stage (Ling & Naughton, 2016).

The "one voice" structure of Chinese political system shapes the coalition. In regard to air pollution policy, the stakeholders have a "sole" value, which is the one that is prompted by the government, while the opponents are normally individuals or grassroot organizations that are repressed by the government, who may or may not form a coalition. The role and function of stakeholders are arranged in the institutional settings, which is decided by the tradition, social norm, the organization's inherent nature of expanding, and the politician's will. A key feature of Chinese context, that differs from Western countries, is that the government controls the messaging to the public through the media, which influences how the public reacts to policies, and the extent to which opposition is given coverage.

SOEs are a critical and defining component of Chinese Coalition formation. SOEs are a very important actor to the Chinese situation, and affect the coalitions and ultimately implementation in unique ways. China's socialist economy is characterized by SOEs dominating key sectors. Due to the special relationship between the Chinese government and the SOEs, which is always described as "the father and the son", in big infrastructure projects, the government has the ability to push things forward fast by mobilizing SOEs. Thus, SOEs are also one of the major "implementors" of environmental policy, usually playing a significant role in policies like the "coal

to gas/electricity" conversion. But its half government, half enterprise character brings SOEs privilege which sometimes distort the market.

Private sector actors include businesses interests. Private businesses are very prone to public policies, primarily because of policy's strong guiding and signaling functions, and because policies frequently change. A subsidy can help businesses to produce certain high value-added products when the initial R&D cost is high, but it can also lead them to just take the advantage of the policy rather than tailoring to market demands. Either way, businesses and people subscribe to the belief that subsidies show the direction the government is moving. Stricter environmental regulations can squeeze "scattered, messy, and dirty" (sǎn luàn wū) industries out of the market. When that happens, social unrest is rare. That's partly because organizations, including NGOs, workers' unions, and associations of industries, are all under the supervision of the government and the CPC, and thus they are hampered in any negotiations with the government. It is also because environmental goals are commonly understood and accepted. Although it doesn't necessarily mean that non-government stakeholder groups agree with specific policy tools, the societal consensus supporting environmental improvement weakens the opposition.

Civil society, which is weak in China, represents another set of actors, which may be involved in civic engagement around policies. Civic engagement, together with the involvement of the media, do push some adjustments in coalition. Similar to the US in the late 1960s, the dramatic rise in public concern with environmental degradation played an important role in the passage of the 1970 Clean Air Amendments in the United States. In China, social trends in recent years, such as higher social awareness and consciousness of the citizens, and more comprehensive agenda of various levels of government, etc., have highly influenced the policy setting and implementation. The public have become increasingly engaged in social issues, mostly through social media, which has emerged as a "bottom-up" way to influence the top-down approach. China's environmentalist movement is the pioneer field for societal changes. In 2013, the $PM_{2.5}$ data revealed by the American embassy induced riots on the Internet. This event triggered the national

air quality standard to change, with more types of pollutants monitored and the subject to control. Action included lower threshold levels, increased air quality monitoring capacity, stricter environmental regulations, and a wider range of air pollution policies. While the government's actions pleased a group of people in big cities in answering their appeal for cleaner air, they are less appreciated, and perceived as a mismatch to needs in poorer regions where economic growth is more urgent, and heavily polluting resource industries may be located. But even this uneven geographic fit of policies to perceived needs are "internal contradictions", which don't overturn the coalition itself.

The coalition shows the following characteristics:

i) The formation of a coalition can be top-down or bottom up. Either way it is subject to government supervision when implementing a policy.

ii) The implementation of a policy has different stages and the coalition is dynamic. Policy output will be passed down within the implementation process. The output of one group of stakeholders is the input of another group of stakeholders. Policy measures are adjusted along the process, and the relative powers among stakeholders also shifts.

iii) Given the top-down integrated bureaucratic structure, cooperation of small stakeholders, such as individuals, although massive in number, is easy to realize; however, it is harder to get big, powerful stakeholders to compromise. To form a coalition and have the goal, power and resources align, it is important to have the big and powerful stakeholders on board. To do so, behavioral change is necessary, either through adjustment of policy and/or adaptation of the implementor, and/or through the accountability system motivating the implementors.

3.3 Flexibility

Although the administrative hierarchy in China appears quite rigid, there's a lot of flexibility in the system for maneuvering, at both the central and the local governments level. This flexibility is reflected in the following aspects.

i) Certain government departments' status can be adjusted with the shift of central government's priorities.

China's political power ultimately lies within the CPC, which has led the seven rounds of public administration reform at the central government level since the 1980s. The intention has been to advance the transition of government from one that is oriented solely towards economic development to one that pursues more balanced between economic and social objectives and is oriented toward the needs of the general public (Xue & Zhong, 2012). The most recent reform on 2018, according to the State Council, was to make the government "better-structured, more efficient, and service-oriented." One of the highlighting features of this reform, was the upgrading of the state environmental protection agency. This was the fourth time the agency has been upgraded. In 1988, the national Environmental Protection Agency was established as a deputy ministry level agency, affiliated with the State Council. In 1998, the Chinese government upgraded the Environmental Protection Agency to a ministry-level agency, which then became the State Environmental Protection Administration. In 2008, the administration was upgraded to the Ministry of Environmental Protection (MEP), which officially became a cabinet member in the Chinese government. In 2018, the another round of institutional restructuring of the State Council upgraded the MEP to the Ministry of Ecology and Environment, whose responsibilities included climate change mitigation and GHG emission reduction, former functions of the National Development and Reform Commission (NDRC); the monitoring of groundwater pollution transferred from the former Ministry of Land Resources, water functional zoning, wastewater discharge management, and watershed environmental protection functions transferred from the Ministry of Hydrology, the supervision and monitoring of agricultural pollution transferred from the

Ministry of Agriculture, the oceanic environmental protection function transferred from the State Oceanic Administration, and the environmental protection function in project areas transferred from the Office of the South-to-North Water Diversion Project Construction Committee.

Every time the agency's status saw an upgrade, it resulted in a broader scope of work and more importance in the Government. This process goes hand in hand with the growing importance of environmental quality in the central government's agenda. This institutional reform ensured a matching administrative body with increased powers to deal with the issues. With the growing importance of environmental issues and the growing power of the environmental agency, the Ministry of Ecology and Environment, stakeholders' behavior is changing. Local governments are re-assessing the weight they give to environmental protection in their work, and enterprises are becoming more serious in responding to environmental regulations.

ii) Cross-ministry coordination mechanism at the "top".

In order to implement a policy that crosses the functions of multiple government departments, certain mechanisms are used to coordinate actions. At the "top", i.e., the central government level, it can take the form of an "Inter-Ministerial Joint Meeting", convocated by the Ministry who initiated the task, and usually a coordination office is set up at that Ministry; or it can take the form of a "Central Leading Group", which usually has a state or deputy state - level official assigned to coordinate the ministries involved. The latter gives more authority to the initiative, and enables more effective coordination in organizing actors, and signals that there is strong will for the initiative from the political leadership.

The coordination of air pollution control is a good example. To coordinate the implementation of the *Air Pollution Prevention and Control Action Plan (2013-2017)* (APPCAP), a cross-ministries coordination mechanism was established the same year the APPCAP was launched in 2013, including the then MEP, then NDRC, Ministry of Industry and Information Technology (MIIT),

Ministry of Finance (MoF) and the Beijing Municipal Government as members, with the coordinating office set at the then MEP. The then MEP had divided the APPCAP into 80 tasks and assigned them to 34 government entities, with clearly stated responsibilities, actions, and timetables. To promote the Beijing-Tianjin-Hebei and surrounding regions' air pollution prevention and control initiative, a coordination group, including the provincial level governments of the region and related Ministries, was launched. In 2018, the coordination group was upgraded to a "Central Leading Group", with vice premier Han Zheng as the director of the group, which shows the growing importance of air pollution control work in this region. Relevant government departments, governments of the jurisdictions in the region, and enterprises are sensitive to, and tuned for, the growing priority of air pollution control.

iii) Local level adaptation

At the local level, although local cadre have to obey the upper-level governments, they also have substantial space to maneuver (Anna et al., 2015). This feature was especially prominent, commencing three to four decades ago, when the sole priority was economic growth. The introduction of market systems released the vitality of the economy, but there wasn't an existing road map to follow. Many places tried to explore the best way to grow, as "wading across the river by feeling the stones". Various successful cases have sprung up, such as the Southern Jiangsu model, the Zhejiang model, and the Shenzhen model.

However, the flexibility feature can work two ways, given different levels of local cadres' motives and motivation, local implementors' capacity, and the availability of resources. Since environmental policies are more technical, and since the decision maker usually sets not only the objectives but also the measures and tools, less room is left for local implementors to customize policies. Sometimes implementation gaps can take place; flexibility at the "top" doesn't always carry down, and measures can either be too rigid, or be mishandled at the local level. Additionally, fragmentation within an administration can occur, and the conflicts which are

suppressed at the “top” can be passed down to the ground level. Especially when the policy is regulatory and mandatory, under the hierarchical political regime, it will mostly be quickly implemented in an upscaling and replication manner. If implemented on a large scale, the intended “cure all” policy encounters different situations among localities, which means there’s no time for local implementors to adjust, explore alternate solutions, or give feedback to the upper level government. This usually brings about errors and distortion. Large scale initiatives run the risk of multiplication of errors and distortions.

3.4 The Accountability System Targeted at Local Leaders

Local government leadership is a very important factor in policy implementation. This is well connected to the “first fiddles” accountability system – a term used in China’s bureaucratic system to describe the party secretary and mayor of one jurisdiction overseeing all major agenda. In China’s hierarchical political-administrative system, policy implementation generally follows a top-down, rational, and technocratic model. This system is characterized by concentrated power at the central government level with an upwards accountability system for mayors at the municipal or county level.

At the local implementation level, the local party secretary and the mayor are usually the persons being held accountable. This measure has been useful in many cases for China. It worked when the evaluation of government cadre was oriented to economic growth, and it worked for the one-child “Family Planning” policy; not implementing it well was a veto for the mayor’s promotion. As part of the government’s agenda, the air pollution policy adopted the same approach. To ensure the implementation of the APPCAP, the MEE signed the “objective and responsibility agreement” with the 31 provinces (autonomous regions, directly controlled municipalities). In the agreement, it clarifies the objectives and tasks of each province, and made this information available to the public. Accompanying and reinforcing the accountability system for air pollution is large-scale environmental supervision and inspection. The environmental supervision is led by the CPC’s environmental protection supervision central committee, with members not only from the then

MEP, but also from the CPC's Central Commission for Discipline Inspection, and the Organization Department, which are the CPC's institutions supervising and managing all levels of government officials. From the end of 2015 to 2017, the committee had visited all 31 provincial areas to inspect the environmental protection work. They talked to 18,448 government officials, and 18,199 were held accountable for not doing their work well.

The accountability system stimulates the "first fiddles" to implement the policy, but it can also cause an implementation gap. Local governments, especially town and township governments, have to deal with an enormous number of tasks from the upper levels. They have limited personnel, yet must respond to a wide variety of work assigned by upper level government departments, like anti-corruption, workplace safety and security, environmental protection, education, poverty reduction, propaganda, etc. In order to report progress regarding the status of those tasks in a timely manner, town and township governments can only use the lowest cost, and shortest time to do the job. On one hand, to avoid punishment, each level of government adds more tasks to the lower level government, which becomes excessive when it comes down to the actual implementing level, and become a burden instead of delivering welfare to intended beneficiaries; on the other hand, due to the lack of resources and capacity, in implementing those policies, some tasks are just simplified as number games. In sum, highly technical and complex tasks are often pushed down to the lowest levels where personnel may be least qualified to handle these ultra-decentralized tasks.

CHAPTER 4

METHODOLOGY

4.1 Method

Figure 4.1 presents a schematic overview of the method employed. First, theoretical and empirical studies on policy implementation were reviewed. Several analytical frameworks based on public policy formulation and implementation research, including Policy Networks, Urban Regime, Advocacy Coalition Frameworks, and Actor-centered Institutionalism, provide perspectives for understanding the complex and dynamic policy implementation process. Empirical studies on policy implementation in North America and China, and studies on the context of China's air pollution policies provide insights on how to approach my research questions. These are discussed in Chapter 3, the literature review.

Based on the foregoing, three air pollution policies were selected. For each policy, the government-issued policy documents, news articles, opinions on Chinese social media (such as weibo and wechat), published or internal evaluation reports, and meeting minutes were thoroughly reviewed, to understand policy implementation in terms of what has been done, and how it has been done. With an understanding of the goals, measures, and the implementation process related to each of the three selected policy, I sketched stakeholder maps (as shown in Chapters 5-7 for each policy case). I then undertook tentative interviews on the implementation of the first policy. After that, research questions and interview questions were refined, and stakeholders of the other two policies were interviewed. Based on all the data collected, primary and secondary, I identified three factors that are important in shaping the implementation process given China's unique characteristics.

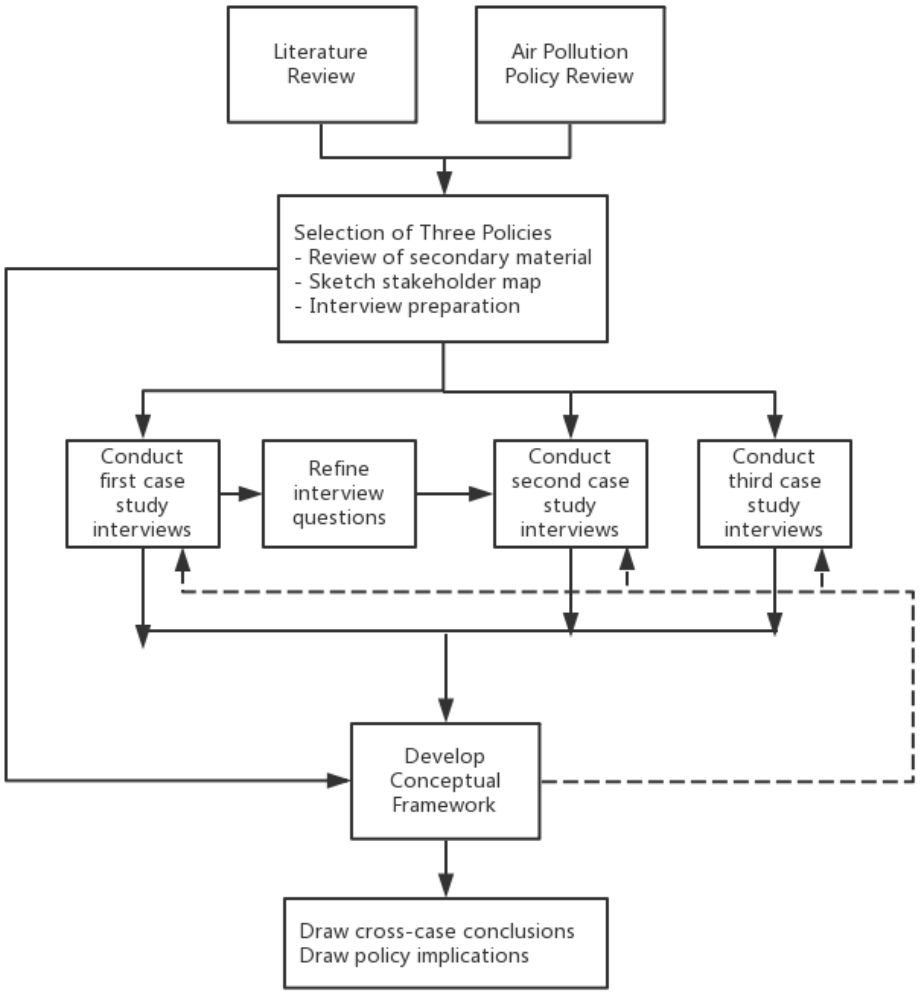

Figure 4. 1 Schematic diagram of research method.

Source: The Author.

To document the implementation process, I focused on the following two types of information: (i) The contextual/institutional factors that affect policy implementation; and (ii) The stakeholders and their behavior during the different stages of implementation, i.e., the policy adoption, the transmission of actions among stakeholder groups, and the policy sustainment. To learn about the implementation stages, I examined the evolution of policy documents, the changing identity and behavior of stakeholders, their perceptions and motives, and the barriers and facilitation that

they experienced during implementation. Given all three policies are ongoing, this study does not put emphasis on the evaluation of outcomes and impacts.

Based on the information collected, including existing analytical frameworks, primary data and secondary data regarding the cases, I extracted the key factors explaining behavior of stakeholders in Beijing's air pollution policy implementation that are especially relevant to the Chinese context, and used them to further develop the conceptual framework, as put forward in Chapter 3. I then applied that framework to narrate the implementation performance of the three policies in Chapters 5 to 7.

The Case Study approach is used in studying the three air pollution policies. According to Yin (2014, p16), Case Studies are "an empirical inquiry that investigates a contemporary phenomenon in depth and in its real-world context." This approach is the preferred method in situations when the main research questions are "how" and "why" questions, and the researcher has no control over events because of the real-life context. It is effective in analyzing causal relationships, rather than just describing a situation. It is particularly useful when the researcher is trying to uncover a relationship between a phenomenon and the context in which it is occurring (Gray, 2004). The evaluation of air pollution policy implementation is to answer the "how" and "why" question, i.e., how the policy is implemented, and why it is implemented in that way. More specifically, the research is seeking an explanation in the Chinese governance context that influences the policy implementation performance. Neither the air pollution event nor the policy implementation is under the control of the researcher (myself). Thus, the Case Study method is a good fit for the research question this dissertation raised. The *case* in case study method refers to the main subject of study. It usually is a concrete entity (e.g., a person, organization, community, program, process, policy, practice, or institution, or an occurrence such as a decision) (Yin, 2014, p237). In my research, the cases are the three air pollution policies selected to study the implementation process.

4.2 The Selection of Policies

In order to study stakeholders' behaviors in air pollution policy implementation and the factors that are influencing them, three particular air pollution policies were selected: (i) The "Coal to Natural Gas/Electricity" Conversion for winter heating, (ii) The New Energy Vehicle, and (iii) The Shift of Production in northern China, i.e., the key polluting sectors, primarily cement, shutting down during the winter heating period (mid-November to mid-March), to avoid overlapping pollution with emissions from winter heating, as case studies.

In selecting those three policies, I first categorized air pollution policy. Air pollution policy can be conceptualized in a number of ways. In this research, I adopt a broad notion of air pollution policy, which is purposive action to control air pollutants generation and emission, and mitigate the impact caused by air pollution. I thus included measures to reduce pollution emission from energy use, industrial production, and automobile use, although some of these policies may be considered as economic or industrial policy. The policy scope is depicted in Figure 4.2.

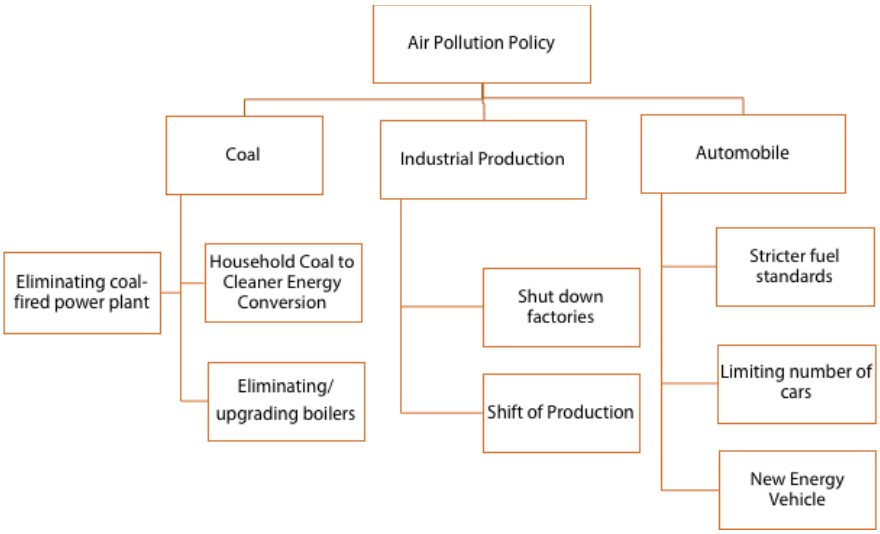

Figure 4. 2 Beijing's Air Pollution Policy Categories Based on Measures Targeting Different Sources

Source: The Author.

To tackle air pollution issues, public policy attempts to create leverage in reducing emissions through intervention in production and consumption systems, or both, including promoting or suppressing certain industries; favoring some types of energy over others; or encouraging people's behavioral changes, such as through subsidizing public transit. Policy tools can be economic/financial, or regulatory.

With just three cases being studied, I want them to be representative but different, that they mirror the main air pollutant sources, cover different air pollution issues, policy tools, pollution control measures, and conflicts. Thus, I set three conditions to select the policies. First of all, they should cover different sectors that contribute to air pollution. The three policies selected are policies in the fields of: (i) Energy consumption, (ii) Promoting new emerging industry, and (iii) Production/restructuring existing industry respectively. They also represent the three major pollution sources. The $PM_{2.5}$ source apportionment results released by Beijing Municipal Environmental Monitoring Center in 2014 shows, the automobile, coal combustion, and manufacturing are the three biggest air pollution sources, accounting for 31.1%, 22.4%, and 18.1% of locally generated $PM_{2.5}$ respectively.[8]

Another prerequisite is that the policies use a wide range of tools, including top-down binding regulation, incentives, taxes, and bottom-up sectoral regulations, or a combination of the foregoing.

A third aspect is that the policies include both direct and indirect pollution control measures. Direct policy means an action addressing an identified issue is through direct measures, although meanwhile it can have an impact on other sub-systems. For indirect policy, an objective other

[8] The latest $PM_{2.5}$ source apportionment results in Beijing Source released by Beijing Municipal Environmental Monitoring Center in 2018 shows automobile, dust, and manufacturing are the three biggest air pollution sources, accounting for 45%, 16%, and 12% respectively. Coal combustion only accounts for 3%, having dropped from the list of major contributors of locally generated $PM_{2.5}$.

than air pollution control is pursued, but air pollution considerations play an important role in making the policy, and its intended impacts (See Table 4.1.)

Table 4. 1 The three selected polices for case study

Issues	Policy	Tools	Policy Type	Conflict
Scattered coal burning generating more pollution in winter heating period	Coal to natural gas/electricity conversion	Binding regulatory	Direct	Higher demand and insufficient natural gas supply; higher clean energy price and low income
Automobile emission pollution	Promotion of New Energy Vehicle	Incentives, tax	Indirect	Between diverging economic interests, i.e., the NEV producers, and the conventional producers
Overlapping Industrial pollution and winter heating pollution	Shift of Production (paused for the winter heating period)	Sectoral regulations	Direct & indirect	Big (state owned) and small (privately owned) producers

Qualitative research receives criticism for its lack of external validity, i.e., for being unrepresentative and the fact that it cannot be generalized. In this regard, Yin (2003) explains the distinction between statistical and analytical generalization: “case studies are generalizable to theoretical propositions and not to populations or universes” (Yin, 2003: 10). This study is explorative and inductive by nature. Restricting the study to three cases allows for detailed research, and enables a thorough insight into stakeholders’ behaviors. The case studies cannot capture all of Beijing’s air pollution policy, but it raises questions and provides some answers on the preferences of stakeholders, the institutional influence, and how, despite conflicting interests, policies are agreed upon and implemented. More cases could be added later to enrich and/or revise the theory, since the research intends to draw conclusions through *analytical generalization* of the cases being studied. The number of cases being studied in this research is not large, but if they corroborate one another, the findings can be considered robust.

4.3 Study Period

The literature on policy implementation points to the need for utilizing timeframes of a decade or more, both in order to complete at least one formulation/implementation/reformulation cycle and

to obtain a reasonably accurate portrait of program success and failure (Mazmanian and Sabatier, 1983).

Given the specific time of existence of the three policies under study, the three policies chosen for case studies in this research have different periods for evaluation. Case 1, Coal to Gas/Electricity Conversion policy considers the period from 2013 when the Air Pollution Prevention and Control Action Plan was launched, and the policy was one of a basket of pollution control measures). Case 2, New Energy Vehicle policy considers the period from 2001, when the Chinese government started a National Science and Technology Major Project to develop the NEV industry. Case 3, Shift of Production policy considers the period from 2015 when implementation of the policy started in the initial 2 cities and 4 provinces in Northern China. All three policies are ongoing, while my evaluation ended in December 2019.

A variety of time periods are selected for analysis because longitudinal study is important in order to observe the policy learning process and its evolution (Sabatier, 1986).

4.4 Data Collection

In my research, data from both primary and secondary sources were collected. The secondary data collection began with a literature review on the three policies in general, including academic journal papers, news clippings and other articles appearing in the mass media on the air pollution policy, policy progress reports on the government websites, such as the Ministry of Ecology and Environment and Beijing Environmental Bureau, and government's studies, such as evaluation reports of Plan implementation.

Primary data was collected through in-depth interviews with key informants. Interviews were semi-structured, and the interview questions were more open and fluid rather than rigid. Based on "talking points", extracted from secondary data, a line of inquiry is followed with simultaneous or follow-up conversational questions. I tried to find answers to the following questions when I

interviewed key informants: (i) Who are the main policy stakeholders involved?; (ii) What measures are used in the implementation of the policy?; (iii) Was the policy distorted in implementation?; (iv) To what extent have target policies been effective?; (v) How are tasks transmitted from one group of stakeholders to another in different implementation stages?; (vi) What problems hinder the achievement of the policy objective?; (vii) What feedbacks from the implementation process can be provided to the policy design stage? In total, I conducted 12 stakeholder interviews. The list of interview questions to key stakeholders are attached in the Appendix.

Besides formal, set-up interviews, I had informal chats with several of my former colleagues regarding the policies I studied. Those chats happened in the forms of phone calls or dialogues via WeChat, a messaging APP being widely used in China, or in person. Some are my close friends, and I talked to them and exchanged opinions during my study whenever questions raised up. I got very important information from those chats, such as my former director, who told me about how effective the inspection is when I was in Beijing and visited him. In fact, having access to the inside knowledge and insights from my former colleagues in the Chinese Academy for Environmental Planning,[9] and talking with researchers who directly or indirectly involved in the making of those environmental policies, and the environmental inspection, was a very important part of data collection in my methodology.

The biggest challenge in data collection is the limited access to high level political leaders – especially in China's context; information and data is often very difficult to obtain without 'guanxi' (personal networks). I was fortunate to interview a few representatives of the key stakeholders in the "Coal to Gas/Electricity" conversion and the "Shift of Production" cases, such as the general

[9] Chinese Academy for Environmental Planning is a think tank affiliated with China's Ministry of Ecology and Environment. It is the main institute which provides technical support to MEE on the national Five-Year Plans on Environmental Protection, the APPCAP, and other important environmental plans and policies. It ranked number 36 in the Top Environment Policy Think Tanks in the 2018 edition of the Global Go To Think Tank Index Report, and ranked number one in China in this category.

manager of PetroChina Beijing company, a division director of Beijing Agriculture Commission who was directly involved in the implementation of “Coal to Electricity” conversion; and I got from a former colleague an internal meeting minutes in which the director of Construction Material Association talked extensively on the implementation of “Shift of Production”. For the New Energy Vehicle case, although I interviewed someone from the Ministry of Industry and Information Technology, a key stakeholder in this industrial policy, I did not get the chance to interview the people who are directly involved in the New Energy Vehicle policy making. Given the problems in accessing key stakeholders in this policy, I adapted my methodology in collecting primary data, and relied more on information from other sources, such as the minutes from interviews of stakeholders by media. I found an interview transcript published by Caixin, an economic and financial news agency. In this interview transcript, Chen Qingtai, who was directly involved in the policy design at the top, provided the rational and consideration of how the New Energy Policy was made.

Given that this study is more focusing on how public sector stakeholders behave in policy implementation, most of the interviews I conducted were with government and SOEs stakeholders. I interviewed one household who converted from Coal to Natural Gas, two New Energy Vehicle sales agencies targeting at different consumer groups, and had unstructured chats with friends who are New Energy Vehicle consumers. Those interviews and chats provided information on how the policies are received by the public (consumers) and private sector actors.

4.5 Data Analysis

The proposed Conceptual Framework as shown in Figure 3.1 was used to shape the analysis of data collected. *Explanation Building*, described below, was used in an iterative manner to polish the theoretical proposition.

- Initial theoretical proposition
- Comparing the findings of case study 1 against the initial proposition
- Revising the proposition

- Comparing the revision to data from case study 2 and 3
- Revising the proposition, drawing on the on the commonalities and differences among the case findings.
- Drawing cross-case conclusions
- Developing policy implications

I assessed the information collected through secondary documents against the information provided by interviews (including both qualitative and quantitative data). In this way, triangulation was used to corroborate interview data with information from other sources, so different dimensions of how one policy is implemented are captured.

To elaborate the implementation of the three policies, I followed the structure of the conceptual framework, using the facts and findings about the policy implementation to explain how they reflect the factors of the conceptual framework.

CHAPTER 5

"COAL TO GAS/ELECTRICITY" CONVERSION POLICY IMPLEMENTATION IN THE GREATER BEIJING REGION

This chapter is about the implementation of the "Coal to Gas/Electricity" Conversion Policy, an important measure designed to reduce air pollution in the Great Beijing Region. Joint efforts of jurisdictions in the Region have been taken to tackle pollution generated by coal burning power plants, transportation and industry, and the coal burning for residents' use became a so called "action on the last kilometer issue" .[10] According to this policy, departments at different levels of government, SOEs, private sector enterprises, and the public were involved. Campaign style implementation under the accountability system over accomplished the goal of conversion, but caused natural gas shortages; SOEs addressing urgent needs and making policy adjustments showed the adaptability and flexibility of the system.

5.1 Background

China is the largest coal producer and consumer in the world. Compared to other types of energy sources, the cost of coal production and transportation is lower, and its yield and supply are more stable. Guan and Liu (2013) found that over-reliance on coal is the most important factor in high levels of $PM_{2.5}$ in Beijing-Tianjin-Hebei (BTH) region. Coal-intensive industries, followed by emissions from over 5 million cars, are the main source of air pollution in Beijing. In winter, the problem is compounded by suburban and peri-urban homes heated with coal-fired stoves. By studying the pollution related to coal burning in the BTH region in December 2015, Zhang et al (2017) found coal combustion contributes significantly to the high $PM_{2.5}$ concentrations. Residential coal burning contributed 50% to the monthly averaged $PM_{2.5}$ concentration. Sun et al (2013) estimated that the total dust emissions from residential coal combustion are 2.7 times higher than those from industrial coal usage. Because there are no pollution treatment devices installed in domestic coal stoves, emissions from residential coal are much higher than those of

[10] This was said by Lei Yu, the deputy director of air pollution control institute, Chinese Academy of Environmental Planning, in a presentation he gave on Phoenix TV.

coal-fired power plants and industrial boilers. One ton of residential coal has emission factors that are 24, 3 and 139 times that of low-emission coal-fired power plants in terms of SO_2, NOx and dust respectively.

Coal has always been the main source of energy for heating in northern China.[11] By the end of 2016, urban and rural households in the northern China had a total heating area of 20.6 billion square meters, of which 83% used coal.[12] In Beijing, there are 1.1 million households that use coal as an energy source; 92% of residential coal is used for winter heating.

About 400 million tons of standard coal are burned for heating in the winter in China each year, of which half are "scattered coal"[13] (including those burned in low efficiency broilers). It's estimated that scattered coal burning in winter in Beijing, Tianjin, and Hebei made up 10.6% of the total coal consumption in the region. Scattered coal is from a variety of origins, mainly surrounding areas such as Shanxi, Inner Mongolia, Shaanxi, and Ningxia, with some locally mined, and the quality of scattered coal is hard to control. According to an investigation by the quality supervision bureaus and trade and industry bureaus in Beijing and Hebei Province in 2016, by examining the samples from the 185 coal stores in 75 counties/cities/districts, the rate of compliance for all three indicators (total sulfur, ash content, and volatile matter) is only 3.1%. In addition, most of the domestic stoves that rural residents in northern China use have very low burning efficiency, which cause higher pollution emissions.

[11] There's no central heating system in the southern part of China in winter for historical reasons. In the 1950s, because of the scarcity of resources, the central government drew a line along Qinling Mountains and the Huai River to separate north and south: north of line had a centralized heating system for whole neighborhoods, and south of line didn't have any centralized heating system. This policy has been in place for more than 60 years.

[12] Northern China winter cleaner energy heating plan (2017-2021), 2017.12.

[13] Scattered coal refers to the coal directly used for decentralized combustion, such as in small boilers, small kilns, and residents. Comparing to centralized coal, which is combusted in power generation and other industries, scattered coal is inferior in quality and more polluting. It doesn't go through washing and clean processing and has higher ash and higher sulfur content. The decentralized uses have not taken environmental protection measures, such as dust removal, desulfurization and denitrification after combustion.

During the winter heating period, the contribution of residential coal burning to air pollution may get even higher than that from automobile and industrial sources.[14] During heavy pollution days, especially when measures like restricting the number of cars on the road and suspending industrial production are carried out, coal burning for heating becomes a salient source of fine particulate pollution.

To tackle this problem, the "Coal to Gas/Electricity" conversion policy, as an important air pollution control initiative, was launched by a series of government documents. At the national level, it was initially launched in the National Air Pollution Prevention and Control Action Plan (2013-2017) (APPCAP) by the State Council of China (State Council of PRC [2013] 37), issued on September 10, 2013. The Action Plan is the flagship plan to tackle China's air pollution. It is the first of its kind in terms of comprehensiveness in combating air pollution. More air pollution prevention and control goals and measures have been set up at the front end, such as phasing out dated production and cleaner energy use. Key metropolitan regions, key control zones, and key heavy polluting industries are emphasized. The APPCAP has also set up legal and institutional mechanisms, such as local government's accountability for environmental quality within its jurisdiction, compulsory disclosure of environmental information, regional coordination and public participation.

In the APPCAP, the "Coal to Gas/Electricity" policy requires the three metropolitan regions in Eastern China, i.e., the Beijing-Tianjin-Hebei, Yangtze River Delta, and Pearl River Delta, to accelerate their coal to gas conversion in both industrial and residential use. It set a goal to complete conversion of all coal-fired boilers, industrial kilns and furnaces, and enterprise self-operating coal-fired power plants by 2017. For residential use, it called for banning high polluting

[14] China Environmental News. (2016-01-29). Is it just coincidence that the winter heating period is overlapping with heavy smog days? Controlling scattered coal is the key.

fuel throughout urban built-up areas and inner suburban areas, and allowing only clean coal to be used in outer peri-urban and rural areas. To implement such conversion, government subsidies were provided for three years, to support front-end heating equipment installation and household natural gas/electricity consumption in the winter. Stepped (tiered) electricity/natural gas prices were not applied in some regions.

To achieve those goals, the APPCAP listed three main measures:

(i) Rectify coal-fired boilers. Those burning under 10 tons/hour in built-up areas in prefecture level cities and above are banned; and the building of new coal-fired boilers with a capacity under 20 tons/hour is prohibited;

(ii) Control the total consumption of coal. The three metropolitan regions, i.e., Beijing-Tianjin-Hebei, the Yangtze River Delta, and the Pearl River Delta, should try to achieve absolute decline in total coal consumption through gradually increasing the ratio of imported electricity from outside the region, the supply of natural gas, and the intensity of non-fossil fuel usage;

(iii) Ensure the supply of natural gas. New natural gas transmission pipelines with a capacity of over 150 billion cubic meters were built, serving the BTH, the Yangtze River Delta and the Pearl River Delta. The new supply of natural gas should first be allocated to residential use as a substitute for coal.

A series of documents from the MEP have stemmed from the APPCAP to reinforce the efforts on coal to gas/electricity conversion by specifying objectives, mandates, measures, financing, and the distribution of tasks among stakeholders to implement the policy. The list and brief introduction of them can be found in the Appendix.

Relevant to the “coal to gas/electricity” conversion policy, some policies commissioned by other stakeholders are supportive or complementary to the policy (Appendix A). For example,

(i) To provide financial support for the conversion, in May 2017, the Ministry of Finance, together with the Ministry of Housing and Urban & Rural Development, the MEP, and National Energy Administration issued "the announcement on financial funding supporting pilot cities in Northern China using clean energy for winter heating", calling for cities, especially the "2+26" cities in the Beijing-Tianjin-Hebei air shed,[15] to apply for pilot projects. The support was designated for three years, the financial funds allocated being 1 billion yuan for provincial level cities, 0.7 billion yuan for provincial capitals, and 0.5 billion for prefecture level cities.

(ii) To ensure a stable supply of natural gas, the State Council republished the Opinions on Building a Long-term Natural Gas Supply Mechanism by the NDRC (State Council General Office [2014]16), in which one of the major tasks is to support the "Coal to Gas/Electricity" project, as stated in the APPCAP. Every year, the NDRC and the National Energy Administration would issue announcements ensuring natural gas supply for residential use and require provincial level DRCs to sign residential natural gas supply security responsibility agreements (NDRC [2014]22, [2015]819, [2016] 915, and [2017] 1088). The announcements and agreements specified that the local DRC should urge the three major oil companies of China, PetroChina, Sinopec, and China National Offshore Oil Corporation (CNOOC), to ensure the supply of natural gas for residential use.

(iii) The energy SOEs made plans to increase their capacity to deliver natural gas/electricity supply for the winter heating period. For natural gas, Beijing Gas Group, which is in charge of natural gas infrastructure construction in the Beijing "coal to gas" project, published the "Engineering Environment and Social Management Plan for the 'Coal to Gas' Program during the

[15] The "2+26" cities refers to the 28 cities "on the air pollution passage of Beijing-Tianjin-Hebei region", which include the two centrally administered municipalities, Beijing and Tianjin, and 26 cities in the surrounding provinces of Hebei, Shandong, and Henan. This term was first brought up in February 2017, in the Working Plan in 2017 of Air Pollution Control in Beijing-Tianjin-Hebei Region, as a coordinated effort to tackle the regional air pollution issue.

13th Five-year Plan Period in Beijing". Prior to the plan being issued, the group had been expanding its gas sources and transmission pipelines and intensifying its pipeline network in Beijing. In the plan, it specifies engineering plans to extend its pipelines to villages in Beijing. For electricity, the State Grid in 2013 has put forward the "two substitutes" strategy, which is, to substitute coal with cleaner energy for electricity generation, and substitute coal with electricity for energy consumption, to reduce the air pollution emission in the urban area. In March 2017, the State Grid Beijing Electric Power Company started on its planned 46 power transmission and distribution projects,[16] which increased Beijing's average urban household electric loads from 1.5 kva to 6 kva and average rural household electric loads from 1.5 kva to 9 kva.

The APPCAP is a general plan for the whole country. The region specified in the APPCAP is rather general; the documents that have since been released specified the cities, and the number of households that need to upgrade their heating infrastructure. Especially in the winter heating plan, coal to clean energy work is gradually becoming more regulated and systematic.

Corresponding to the national level plans, Beijing had issued a Clean Air Action Plan (2013-2017) to arrange air pollution control tasks and facilitate actions. It sets such targets as Beijing's coal consumption being capped at 10 million tons by 2017, a 13-million-ton reduction compared to 2012, and capped at 5 million tons by 2020. By 2017, cleaner energy such as natural gas and electricity would accounts for more than 90% of the energy mix, while coal would account for less than 10% by 2017. To facilitate the implementation of the plan, a Beijing Clean Air Action Plan Tasks Breakdown (2013-2017) was issued to distribute the 84 key tasks to 42 Beijing government authorities, including district governments, the DRC, and the Industry and Information Technology Commission, plus 23 enterprises including PetroChina, Sinopec, and the Beijing Electric Power Company. It specified the timetable and people (both their name and position) in charge for each

[16] Source: cnr.cn. (2017-03-01). The 2017 Beijing "Coal to Electricity" grid infrastructure project unfolded. Accessed on February 1, 2020 from http://news.cnr.cn/native/city/20170301/t20170301_523628948.shtml.

task. Additionally, each year for the 2013 to 2017 planning period, there were task lists which are further broken down from the Tasks Breakdown document.

Other plans of Beijing that are relevant to the “coal to gas/electricity” conversion include the “Coal Consumption Reduction and Clean Energy Development Work Plan 2013-2017”, and the breakdown of this work plan to each year with more specific tasks; the “Beijing Rural Area ‘Coal to Cleaner Energy’ Conversion and Coal consumption Reduction and Substitution Implementation Plan”, “Beijing Facilitating Residential Coal to Cleaner Energy Substitution Work Plan (2016-2020), “Beijing Electric Heating off-peak Subsidiary Method”, etc. Those plans together constituted a “coal to clean energy” conversion policy cluster for Beijing.

5.2 Implementation Description & Assessment:

5.2.1 What happened

Beijing had started its “coal to electricity” conversion programming for winter heating as early as 2003, ten years prior to the Action Plan being launched. Back then it was mainly in the hutongs (alleys formed by lines of courtyard housing quadrangles where older Beijing residents often live) in the urban core area, with just a few hundred households targeted. The number of households targeted then increased to a few thousand in 2006, and tens of thousands in 2007. In 2013, when the Action Plan was launched, the conversion of coal to electric heating in rural Beijing was put onto the agenda, and in 2016 and 2017, the conversion was expanded to rural Beijing and done on a larger scale (Table 5.1). Especially in early 2017, the average $PM_{2.5}$ concentration in the BTH region was still much higher than the ambitious target specified in the APPCAP, making the prospects of achieving the target problematic. Under these circumstances, in August 2017, the “Beijing-Tianjin-Hebei and Surrounding Regions Strengthened Air Pollution Prevention and Control Action Plan in 2017-2018 Fall and Winter” (Strengthened Plan hereafter) was launched to further stress the issue and assign actions to relevant actors.

From 2013 to 2017, there have been 900,000 households in 2,036 villages that have finished the "coal to cleaner energy" conversion in Beijing, and this prevented the combustion of 2.7 million tons of scattered coal[17]. Infrastructure has been upgraded as well. With the growing demand for electricity, seven new electric power transmission lines were being built, with the goal of increasing the share of imported electricity to 70% of total electricity consumption in Beijing by the end of the 13th Plan.[18]

Table 5. 1 Beijing's Goal and Actual Completion Outcome

	Goal	Achievements
2013	n/a	44,000bungalow households in urban core area converted from coal to electricity
2014	n/a	20,000 households in apartments in inner urban districts, all "coal to electricity" 70 demonstration villages from coal to electricity for 2013 and 2014.[19] 2 demonstration villages in rural Beijing converted to gas.
2015	n/a	91,000households converted to electricity 19 villages converted to gas
2016	400 villages	663 villages, 227 thousand households - 199,000households in 574 villages are converted to electricity - 28,000households in 89 villages are converted to natural gas
2017	700 villages 300,000households	700 villages, 302,000households; - 207,000in 515 villages are converted to electricity - 95,000 households in 185 villages are converted to natural gas

Data source: Beijing government website; "coal substitution work report in rural area" by Beijing Agricultural Commission.

A very large amount of work has been put into the project. For the coal to electricity conversion during 2016 and 2017, the State Grid Beijing company had up to 2,800 sites under construction for electric networks, and more than 10,000 people were working at the same time.[20]

[17] Source: National Energy Administration. (2017-11-15). Beijing completed the "Coal to Clean Energy" Conversion in 700 villages this year. Accessed on February 1, 2020 from http://www.nea.gov.cn/2017-11/15/c_136754403.htm.

[18] Source: Finance.china.com.cn. (2017-04-21). On the end of 13th five-year plan period, Beijing's imported electricity will reach 70%. Accessed on February 1, 2020 from http://finance.china.com.cn/news/20170421/4184986.shtml.

[19] Xinhua. (2017-04-22). Beijing: coal to electricity is on its toughest. Accessed on February 1, 2020 from http://www.xinhuanet.com/local/2017-04/22/c_1120854758.htm.

[20] Mofcom.gov.cn. (2018-01-11). For the blue sky: the 15 years path of Beijing's coal to electricity. Accessed on February 1, 2020 from http://csr.mofcom.gov.cn/article/csrnews/CSRnews2018/201801/20180102697134.shtml.

Subsidies are abundant for Beijing residents. Besides paying part of the cost for the heating equipment, Beijing's government also provides subsidies for winter heating electricity. These subsidies have been available since 2003, when the conversion started. Since 2015, Beijing's Municipal Government applied the same off-peak electricity subsidies to both urban and rural residents. On top of the lowered 30 cent/kwh rate, both municipal and district level governments subsidize 10 cent/kwh each, which means residents only need to pay 10 cent/kwh for off-peak time, from 9 PM to 6 AM the following day.[21] Since 2016, the subsidies have been given directly to the households.

To reduce the financial burden on residents, Beijing's government subsidized 2/3 the cost to upgrade housing, which includes adding insulation on external walls, upgrading the heating units and the internal wiring. Thus residents just need to pay the remaining one third of the cost.

According to State Grid Beijing Electric Power Company's assessment based on the electricity consumption data for the 2016 to 2017 winter period for approximately 210,000 "coal to electricity" households in 14 districts, one household's electricity usage (based on mean household consumption) in one heating season is 5528.4 kwh, which costs 2,135.60 yuan; households only need to pay 1,661 yuan after government subsidies. This out-of-pocket money is about the same as, or even lower than, the cost to burn scattered coal.[22] Based on the online monitoring of some 2,000 users, during the coldest days in the winter heating period, the average room temperature reached 19.1°C, and a questionnaire showed 95.8% of the converted users

[21] Ifeng.com. (2016-07-22). Beijing's coal to electricity project for the 13th Five-Year Plan period started. Accessed on February 1, 2020 from http://news.ifeng.com/a/20160722/49528083_0.shtml.

[22] Xinhua. (2017-04-22). Beijing: coal to electricity is on its toughest. Accessed on February 1, 2020 from http://www.xinhuanet.com/local/2017-04/22/c_1120854758.htm.

are satisfied with their air source heating units, and 79.5% are satisfied with their heat storage units.[23]

Table 5. 2 Logical Framework of "Coal to Gas/Electricity" Conversion Policy in Beijing in 2013-2017

Policy input	output	outcome	impact
- Financial subsidy to the installation of hanging furnaces in residences, and the subsidy for natural gas and off-peak electricity - Mobilizing environmental and inspection workers - Intensive inspection - National government redistributes natural gas at a wide regional scope by mobilizing major SOEs	- 4.74 million households in "2+26" cities have upgraded from coal to gas/electricity in 2017 - Natural gas pipes have been installed - Electrical grid has been upgraded - All the villages had households being inspected	- It contributed to pollution reduction. $PM_{2.5}$ levels have decreased by 25% in the BTH region. - Households can now enjoy cleaner indoor and outdoor air quality	- For Load leveling gas storage infrastructure got improved - It pushed the new technology in heating development, which has had positive effects on the transformation and upgrading of the manufacturing sector and supply-side reformation -It extended the electric market - Residents have the electricity load in the homes 4 to 5 times higher than before. It lays the foundation of energy consumption structure change in rural area, not only can they use cleaner energy to heat, but also provide the possibility of improving their living conditions and enjoying a more "electric" life

Compared to Beijing's incremental, step-by-step upgrading of residence winter heating over the course of a decade, Hebei's action on "coal to gas/electricity" is more drastic. In the Strengthened Plan, which was issued in August 2017, and pertaining to the "coal to gas/electricity" policy, it required the number of households in the BTH region that upgrade winter heating systems to gas/electricity to be no less than 3 million by October 2017. That left just two months for the region to conduct the conversion. Hebei's goal is to turn 1.8 million households to cleaner heating. The sudden ratification of the Strengthened Plan just two months before the start of the winter heating period in 2017 possibly was the fastest energy transition on this scale ever attempted,[24] Hebei actually overshot the goal: more than 2.53 million households converted their heating fuel from coal to electricity or natural gas. Of which, 2.32 million, or 92% of the total, were

[23] Xinhua. (2017-04-22). Beijing: coal to electricity is on its toughest. Accessed on February 1, 2020 from http://www.xinhuanet.com/local/2017-04/22/c_1120854758.htm.

[24] Arthur Wyns, Katharina Wecker on dw.com. (2017-12-15). Accessed on February 1, 2020 from https://www.dw.com/en/chinas-u-turn-on-rapid-end-to-coal-heating/a-41816867.

converted to natural gas.[25] The Province also closed as many as 36,000 coal-fired boilers over the year.[26] Mostly due to Hebei's over shooting targets, in December 2017 there were actually 4.74 million households in the BHT region that converted their heating units, almost 60% more than the goal, according to the investigation by the Ministry of Ecology and Environment. As described by one of my interviewees, who was one of the inspectors in Langfang, Hebei, "it was hard to find a construction worker. All of them were grabbed to install natural gas pipelines. There were normally plenty of them in the street waiting for a job."

In Hebei, before 2016, the main measure adopted regarding scattered coal aimed to substitute it with cleaner coal. Since it is hard to monitor whether households are using cleaner coal over less expensive scattered coal, after 2016 the coal to gas/electricity and other cleaner energy (for example, geothermal, solar, and biogas) conversion prevailed.

Local coordinating offices reflect the different contexts of each place. At the local level, after the "coal to gas/electricity" task is assigned to the governments, a coordinating office is usually set up and affiliated to one government department. In Beijing it is in the agricultural commission, since most of the tasks are in the rural villages. In Hebei, some cities are assigned to the urban affairs bureaus, some are assigned to the local Development and Reform Commissions (DRC), and some are assigned to the environmental protection bureaus (EPBs). This shows the different development trajectories of these two jurisdictions. Beijing is upgrading its infrastructure in the rural areas, while Hebei is still trying to push the policy in the urban districts and gradually disseminate it to the countryside.

[25] Bjx.com. (2018-06-22). Hebei officially admitted: too much coal to natural gas was done. Accessed on February 1, 2020 from http://news.bjx.com.cn/html/20180622/907572.shtml.

[26] Reuters (2018-01-29). China's Hebei halts coal to gas heating conversion project. Accessed on February 1, 2020 from https://www.reuters.com/article/us-china-pollution-gas/chinas-hebei-halts-coal-to-gas-heating-conversion-project-report-idUSKBN1FJ0CD

Although there were many challenges in switching to natural gas, people's livelihoods have indeed been improved. With natural gas, kitchens are much cleaner, and people don't need to pile scattered coal in their yards in the winter (Figure 5.1). Households interviewed indicate that natural gas can fulfil their heating, cooking, and hot water needs. When it's affordable, they are willing to use natural gas (Figure 5.2). It is much cleaner: it doesn't blacken hands/walls, and left cleaner air to breathe, and is more convenient. In the shorter term, the government is subsidizing the better product. The expectation is that in the long run, people's income will increase, and they will be more used to a higher living standard, and the transition to cleaner energy consumption will be achieved on a sustainable basis.

Figure 5. 2 Residents Charging Natural Gas Card

Source: The Author.

Figure 5. 1 Natural Gas Equipped Kitchen with Coal Smoke Stained Walls

Source: The Author.

Besides its impact on livelihood of residents, the policy has imposed a significant effect on emission reduction from scattered coal combustion. The result of the latest $PM_{2.5}$ source apportionment study for Beijing in 2018 shows, coal combustion accounted for just 3% among the contributors, down from 22.4% from the same study conducted in 2014.[27]

[27] Data source: Beijing Municipal Environmental Monitoring Center.

5.2.2 Implementation assessment

Stakeholders

There are multiple stakeholders related to the “coal to natural gas/electricity” conversion policy. In brief, the main actors include: central government, local government, SOEs, private enterprises, and residents. Figure 5.3 shows the hierarchy of the stakeholders in the public sector, namely, governments and SOEs.

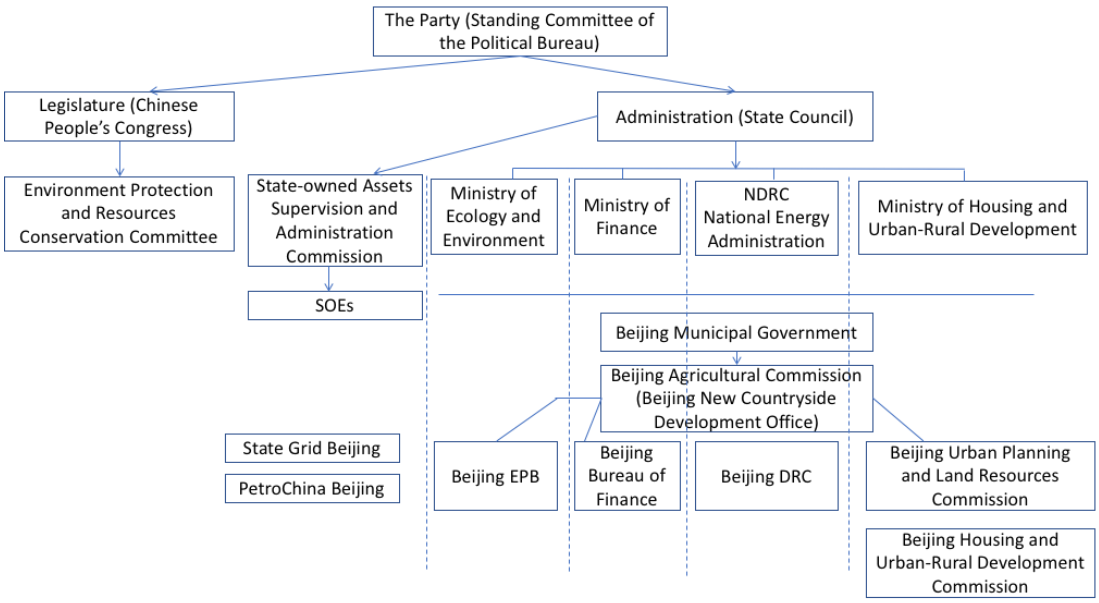

Figure 5. 3 Hierarchy of Public Sector Stakeholders Related to Beijing “Coal to Natural Gas/Electricity” Conversion Policy

Source: Author

(i) In terms of the national government, under the State Council, several government departments are involved. Their main role is to make decisions on the goals, tasks and implementation tools of the policy, and administrate and inspect the policy’s implementation at local level.

a. NDRC/National Energy Administration: These agencies make national natural gas development and consumption plans, set winter heating price policies, coordinate supply/demand balance, close demand/supply gaps in a timely manner, supervise the

operation of Oil and Gas SOEs, and build and improve a gas supply and usage accountability system.

b. Ministry of Environmental Protection (changed to Ministry of Ecology and Environment in 2017): This agency takes the lead in designing the “coal to gas/electricity” conversion policy, monitors / inspects the implementation of the policy.

c. Ministry of Finance: This agency, at the national level, is responsible for the “coal to gas/electricity” subsidy design and distribution; formulating guidelines for local subsidies, and managing the Special Funds for Air Pollution Prevention and Control.

d. Ministry of Housing and Urban-Rural Development: This ministry is responsible for administrating the heating provision in urban and rural households; making plans, policy, and standards for the architecture of housing, including better housing insulation solutions.

(ii) Local government has similar departmental divisions as the central government. This structure is called “strips and blocks” (Figure 5.2). The vertical lines are strips, representing authorities at different levels of governments, and the horizontal blocks are the different departments at the same level of government. Local government, led by the mayor (whose work is supervised by the city/county’s communist party secretary), coordinates relevant government departments to implement the policy.

(iii) Energy SOEs: These companies, under the administration of State-Owned Assets Supervision and Administration Commission, ensure energy supply for the conversion. Oil and gas Companies, including PetroChina, Sinopec, CNOOC, and China Gas, are requested to ensure a stable supply of natural gas, which includes building more underground gas storage and LNG load leveling infrastructure, and purchasing natural gas from the international market. State

Grid improves grid capacity, thereby supporting “coal to electricity” conversion project design and implementation.

(iv) The private sector is significantly involved in the implementation. Large amount of equipment and labor were needed to realize the conversion, through government procurement. From the manufacturing of hanging furnace and air source heat pumps, to the installation of pipes and devices, private actors got a lot of business. They partnered with the government and SOEs in the policy implementation. According to one interviewee from one natural gas SOE, in the couple months after the “coal to gas” policy goals were set up and before the heating period began, “workers in the hanging furnace factories industry in both northern and southern China were working at full capacity to fulfill the soaring orders; all the handymen usually wandering in the street for jobs were recruited to install the natural gas transmission pipes, such that the households who are renovating their houses couldn’t find anyone to hire”.

(v) Residents as the receiver of the direct policy outcome, can only passively accept the conversion. But they fall into two groups: one is happy with the cleaner environment and less work to ignite the coal and keep the stove on, although they need to pay more; the other one doesn’t want to spend more, and may choose to use coal again.

(vi) Other stakeholders include development banks who provide funds for the policy, and media who covers the policy and its implementation. As its first investment in China, the newly established Asian Infrastructure Investment Bank (AIIB) provided a 250 million USD loan to support the natural gas transmission network in Beijing in December 2017, which will benefit 217 thousand households in 510 villages in Beijing.[28]

[28] People.cn. (2017-12-12). AIIB’s first investment in China – Coal to Gas Conversion Project. Accessed on 18 December 2019 from http://energy.people.com.cn/n1/2017/1212/c71661-29700089.html.

Coordination mechanisms

The foregoing list of stakeholders is a simplified sketch. In the real world, each actor is not a single individual, nor a single organization, but multiple organizations comprised by many individuals. “Coal to Gas” conversion is just one of the very many agendas of the central government. The coordination across the stakeholders, given the complex network of multiple government departments, even just within the top tier government, is one of the biggest challenges in implementing the policy. An “Inter-Ministerial Joint Meeting” mechanism has been established, with the then Ministry of Environmental Protection being the “coordinating” department, and the then NDRC, MIIT, MoF, etc. as “involved” departments. MEP had divided the APPCAP into 80 tasks and assigned them to 34 government entities, with clearly stated responsibilities, actions, and timetables.

In practice, there is a “hierarchy” of power among government departments, such that the environmental protection agency has “weaker” power than the economic development agencies. In implementing this policy, the “involved” departments have higher power level than the “coordinating” departments, yet they gain less credit from doing the job, which negatively effects efforts to implement the policy. According to one of my interviewees, a leading environmental planner from MEP who was present at the high-level meeting where the drafted Action Plan was under discussion among involved government departments, “the other ministries involved were unhappy about the added tasks. The reason is obvious: the work needs action from multiple government departments, but the glory of the accomplishment of work will mainly go to the MEP. The other ministries have very little motivation to invest their resources to support the APPCAP.”

To facilitate the implementation of the multiple and multi-faceted policies in the Action Plan, the State Council promoted the MEP. The recent upgrading to Ministry of Ecology and Environment reflects the additional functions that were given to this Ministry.

Given the similar government department division at the local level, similar coordination issues exist. Environmental Protection Bureaus (EPBs) used to be the weaker department, and environmental issues were usually less prioritized than economic growth. With the growing importance of a cleaner environment, EPBs gained more power. Since the priority has been negotiated and set up at the top, and strict inspection is conducted regularly from top-down, local mayors have put more emphasis on environmental quality.

Given air pollution's nature of cross-boundary transmission, regional coordination is another essential factor in achieving the policy goals. In October of 2013, one month after the APPCAP was launched, the "BTH and surrounding region air pollution prevention and control coordination group" was set up. It is essentially an Association of Governments of metropolitan regions involved in the environmental field. The group is comprised of personnel from the six provincial level governments in the Region, and relevant ministries. The main function of the group is to solve cross-boundary environmental problems, share information, deal with environmental emergencies, report on work progress in each jurisdiction, and make periodic work plans.

However, for the foregoing group, there is an innate design defect. The government entities in the group are at the same level. Due to the cadre evaluation and promotion system, the competition among those same-level cadres is a "zero-sum game", i.e., when one cadre gets promoted, it means the other cadres at the same level will have less chance of being promoted. Thus, the cadres have more motivation to compete than to cooperate. As illustrated in Molotch's urban growth machine theory, "each locality, in striving to make these gains, is in competition with other localities because the degree of growth, at least at any given moment, is finite." (Molotch, 1967, p312) Such a loose group obviously didn't function very effectively among parallel authorities and provincial governments.

In July 2018, the coordination group was upgraded to a "Leading Group".[29] In general, the "leading group" mechanism is proven to be effective on issues that relate to multiple government departments. A leading group is usually led by a vice-president level official or even the president himself, with members from the relevant ministries or provincial directors. In this case, this newly established leading group was led by one State Council vice premier, Han Zheng. The deputy directors are the Minister of MEE, the Mayors of Beijing and Tianjin, and the Governor of the Hebei province. The group members are Deputy Ministers from relevant ministries, and Deputy Governors of surrounding provinces, i.e., Shanxi, Shandong and Henan, and the Inner Mongolia Autonomous region. The change of structure from parallel cooperation in the coordination group, i.e., all members are from the same hieratical level, to vertical authority in the leading group, i.e., a vice premier coordinating the actions, enhanced its function of coordinating the regional efforts in air pollution management, and signals that there is a strong will from the political leadership.

Implementation mechanisms

Leadership is definitely important in policy implementation. It was mentioned by several interviewees who are involved in hands-on environmental protection work. For Beijing's air pollution, the then Vice Premier Zhang Gaoli attended the BTH and surrounding regions' air pollution prevention and control meetings multiple times – this shows the symbolic meaning of the central government's high priority given to the issue. In the bureaucracy, technocratic officials in the MEP play an important role. For example, the Division Director for air quality management, Liu Bingjiang, who studied air pollution in top universities, both domestic and international, has deep knowledge in the field. Leadership at the local level, especially mayors, are the main force that are in charge of, and can drive, the implementation of a policy. For example, Handan city of Hebei province, started the "coal to natural gas" conversion in 2015 very intensively and earlier compared to other cities in the Province, because the then mayor, Wang Huiyong, was pushing very hard to implement this policy.

[29] State Council Office [2018]54, the announcement to establish BTH and surrounding regions' air pollution prevention and control leading group, issued on July 11, 2018.

After strong leadership, “the most useful tool for implementing the “coal to gas/electricity conversion” policy, and other air pollution policy, is the national environment inspection program”, according to the chief planner of MEP’s environmental planning think tank during an interview. In July 2015, the “Environmental Protection Inspection Program” was set up by the Central Leading Group for Comprehensively Deepening Reforms, the policy formulation and implementation body under the Politburo of the CPC. Before this program was set up, the MEP had six regional inspection centers (which transitioned to inspection bureaus in 2011[30]). They are the MEP’s branch agencies that carry out routine environmental protection inspection work in their administrative jurisdictions. The establishment of the Central Environmental Protection Inspection Team has changed the work mechanism of environmental protection inspection from “inspecting the enterprises” to “inspecting the local governments”. The Team has more authority than the MEP’s regional offices, and its actions have been widespread and intensive. Since December 2015, the team started its pilot work in Hebei, followed by 8 batches of inspection in the following 2 years, during which all 31 provincial-level regions were covered. For the Beijing-Tianjin-Hebei region alone, 5,600 inspectors were sent out. 18,199 officials were held accountable for environmental damages.[31] The officials held accountable were publicly named, admonished, ordered to apologize, given Party disciplinary or administrative punishment, or transferred to judicial authorities.[32] They are not only from within the environmental protection bureaus, but also the mayor and secretaries of the Communist Party committee, leaders and personnel from SOEs, and community authorities, and other government departments, including natural resources,

[30] China news.com (2017-11-23). Six regional environmental protection inspection centers changed to regional inspection bureau. Accessed on February 1, 2020 from http://www.chinanews.com/gn/2017/11-23/8383527.shtml.

[31] Xinhuanet.com (2018-01-04). Central environmental protection inspection team gave feedback; 31 provincial-level regions have these problems. Accessed on February 1, 2020 from http://www.xinhuanet.com/politics/2018-01/04/c_1122206360.htm.

[32] China Daily (2017-11-16). Environmental damages: 1,140 Chinese officials held accountable. Accessed on February 1, 2020 from https://www.chinadailyhk.com/articles/214/111/170/1510827726099.html.

forestry, hydro power, housing and urban-rural development, agriculture, urban affairs, industry, transportation, public security authorities.[33]

Figure 5.4 illustrates the process of the environmental inspection that was carried out starting from mid-2017.

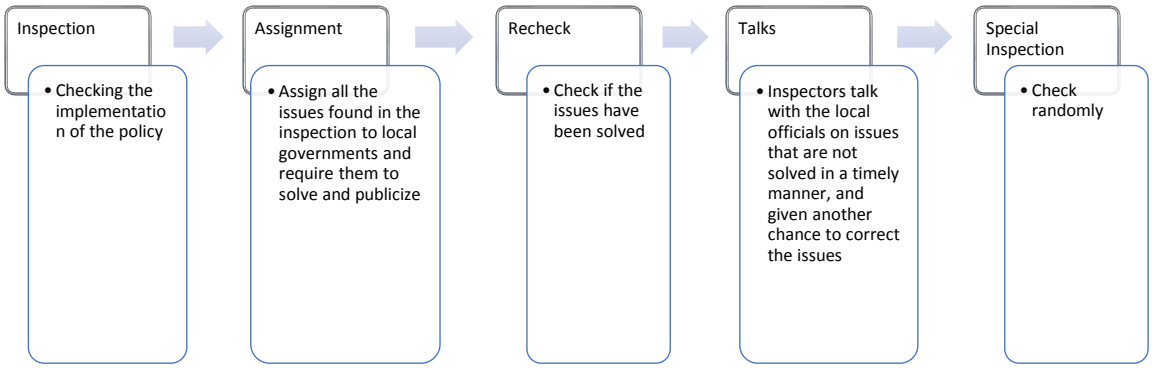

Figure 5. 4 The "Five-Steps" of Environmental Inspection

Source: MEE, Inspection Training Material, 2017.

The new "Environmental Law" issued in 2015 indicates that the local government is responsible for the environmental quality in its jurisdiction, and set up "Talks" as one supervision and management mechanism for air pollution prevention and control. "Talks" mean provincial level governments and above are to meet mayors in whose jurisdiction the air quality objective hasn't been met, to give them "talks", point out the problems, raise requests, and urge them to improve. Receiving those "talks" is embarrassing, and has a negative impact on the local official's career. Thus it is a mechanism to motivate local governments to make environmental protection work their priority.

Modern technology is used to support the inspection program. Big data is used in monitoring local environmental issues, which provides evidence for inspection. Intensive propaganda has made

[33] Youth.cn (2017-12-30). The "Air 10" in 2017 sees its effect, and the blue-sky defense is a win". Accessed on February 1, 2020 from http://news.youth.cn/wztt/201712/t20171230_11224787.htm.

each household know the seriousness of environmental protection, mirroring what was done for the Family Planning policy more than three decades ago.

The very intensive environmental inspection is an example of how environmental authority employees are mobilized to ensure the implementation of the policy. The MEP has mobilized more than 5,000 government employees in environmental protection authorities across the nation to form an inspection team. Mobilizing the in-system personnel is through accountability, a common practice of Chinese government. At the county and town level, the implementors can be from various government authorities, but carry out a specific task when needed.

The “apparatus of mobilization” is a legacy from the Maoist era. Currently, society is more complex, with different interests associated with different groups of people, but the CPC can still mobilize the in-system employees to carry out various tasks that directly penetrate to the town/township and then pass down to villages and communities, where they then work directly with individuals or households.

From the launch of the Strengthened Plan in August 2017 to the end of October 2017, the specified date of completion, there were just two months to finish the tasks. Compared to the need of speedy accomplishments for the “coal to gas” conversion, there was a lack of natural gas network construction, exploration, development, transfer, storage, and peak holding capacity. In addition, a lack of communication between governments and oil companies had caused them to underestimate demand. Although the plausible criticism about the “three oil buckets” selling gas to industries for higher price, SOEs have taken the responsibility of providing cleaner energy to households under the supervision of the government department in charge, the National Energy Administration.

The State Grid can tell the same story. Just between 2016 and 2017, the electric grid to support the “coal to electricity” conversion had been upgraded in 1,551 villages in Beijing. During some

peek construction periods, there were “more than 2,800 working sites, and more than 10,000 workers working at the same time”.[34]

5.3 Roadblocks, Constraints & Adaptation

5.3.1 Gas shortage and gas swap

This fast conversion of “coal to gas” at such a large scale in Northern China created soaring demand for natural gas. Together with other factors, including extremely cold weather and the reduced supply of imported natural gas in the winter of 2017, several northern cities faced a natural gas shortage.[35] At the end of November, Hebei province rang an orange alert on its natural gas supply, which means there was a 10% to 20% natural gas gap between supply and demand. With scattered coal and coal burning stoves being banned, some villages were left without heat in sub-zero temperatures.

Under these urgent circumstances, the National Energy Administration organized a gas swap between the two SOEs to restore heat to northern Chinese homes.[36] PetroChina diverted 700 million cubic meters of its natural gas supply in the southern Province of Guangdong to the north through its transmission pipeline network,[37] which is the first time in China that a provincial branch network transmitted natural gas to the national network, and from one natural gas consumption venue to another. Meanwhile CNOOC supplied 3 to 5 million cubic meters of its natural gas from

[34] Mofcom.gov.cn. (2018-01-11). For the blue sky: the 15 years path of Beijing’s coal to electricity. Accessed on February 1, 2020 from http://csr.mofcom.gov.cn/article/csrnews/CSRnews2018/201801/20180102697134.shtml.

[35] Cnpc.com.cn. (2018-03-28). For the natural gas shortage never happen again, China starts to place out its underground natural gas storage infrastructure. Accessed on February 1, 2020 from http://news.cnpc.com.cn/system/2018/03/28/001682943.shtml.

[36] South China Morning Post. (2017-12-18). Can China switch 70 percent of northern cities to clean heating by 2021 in bid to tackle pollution? Accessed on February 1, 2020 from https://www.scmp.com/news/china/policies-politics/article/2124639/china-convert-northern-cities-clean-heating-systems.

[37] Chinadaily.com. (2017-12-17). Natural gas shortage? Don’t worry, the nation got it all covered. Accessed on February 1, 2020 from https://china.chinadaily.com.cn/2017-12/17/content_35319961.htm.

the South China Sea to fill the gap in Guangdong. CNOOC also sent more than 100 liquified natural gas trucks, each carrying 2 tons of LNG, some 2,300 kilometers to the north.

In the northern coastal city of Tianjin, CNOOC's pipeline can directly connect to PetroChina's network in the BTH region and supply 5 million cubic meters of natural gas per day, which can fulfill nearly a million households' needs in the winter heating period.[38]

Underground gas storage also played an important role in ensuring the supply during the winter heating period. An underground gas storage facility in the southwest municipality of Chongqing transferred its stored gas to the BTH region.[39]

In addition to the formal channels of implementation, *guanxi (Personal relationship)* can sometimes be more important. When there are not enough local resources, mayors and party secretaries would have to ask upper level governments for financial support; when there is not enough gas supply, mayors and party secretaries would seek natural gas across the region by contacting oil company management. Personal contacts usually make this process much easier.

5.3.2 The hypercorrectness and distortion

Pollution prevention and control is one of the three "tough battles", said Xi Jinping during the 19th People's congress in 2017, with the other two being preventing and defusing financial risks, and targeted poverty alleviation. Since being defined as a "battle", the cost would be justified if the result is a "win". Just like extreme measures carried out to ensure a "blue sky" during major events, Beijing's 2017 year-end target of 60ug/m^3 average concentration of $PM_{2.5}$ had to be met.

[38] People.com. (2017-12-07). PetroChina and CNOOC work together to ensure natural gas supply. Accessed on February 1, 2020 from http://energy.people.com.cn/n1/2017/1207/c71661-29690814.html

[39] Cnpc.com.cn. (2018-03-28). For the natural gas shortage never happen again, China starts to place out its underground natural gas storage infrastructure. Accessed on February 1, 2020 from http://news.cnpc.com.cn/system/2018/03/28/001682943.shtml.

Hypercorrectness, an approach sometimes used by the government, thus is perceived as necessary to ensure the completion of the tasks, especially with a very tight timeline. The government has many items on its agenda; if one is not carried out quickly, it usually will affect the larger system. The Strengthened Plan was launched in August 2017, and it required no less than 3 million households to be converted from scattered coal to cleaner energy before the winter heating period, which left only 2 months to finish the vast upgrade. This hypercorrectness mentality in policy making is inherited from Mao Zedong's famous quote "Proper limits have to be exceeded in order to right a wrong, or else the wrong cannot be righted".

As a result of the powerful mobilization and strict inspection, the tasks were not only accomplished, but exceeded targets. To ensure the completion of planned tasks, the national government assigned higher targets than specified in the Strengthened Plan to the provincial governments, then the provincial governments assigned more than their mandated amount to the municipalities and counties. For local cadres, there is less risk of being blamed if more conversion than mandated is completed. In addition, it is better for local governments to take advantage of the subsidies while they are still available. These are some of the reasons why local governments implemented the policy with excessive zeal and converted far more households than planned.

One direct result of the overshooting is the gas shortage. Although the national policy is based on the principles, "conversion to gas when it's suitable for gas, and electricity when it's suitable for electricity", the project was proposed and pushed for broad adoption before the feasibility and potential effects had been carefully studied. This resulted in a great disparity between the proposed policy and local circumstances in different areas. The cost, and the limited time, constrained the choices for cities in Hebei province, created a bias towards natural gas - buildings were mostly converted to natural gas, which costs less at the initial stage for the installation of the equipment. As a result, when the shortage of gas hit in 2017, Hebei could only cease the conversion. China's energy production and consumption landscape posed a big challenge in meeting the soaring demand for natural gas. In 2018, the coal production and consumption were

368 million tonnes (406 million tons) and 390 million tonnes (430 million tons), while the natural gas production and consumption were 160.3 billion cubic meters and 280.8 cubic meters.[40] By comparison, there is a much bigger domestic demand/supply gap and heavier reliance on the international market for natural gas than coal.

The pressurized system that resulted from severe accountability mechanisms, made local cadre "rush to please", as it was put in a commentary in the New York Times.[41] The local implementers' interests are in "satisfying the demands of short-term campaigns rather than in undertaking long-term structural changes".[42] "In order to quickly meet these sometimes questionable goals, some local officials with an eye on career advancement — or simply fearful of being sacked — have overshot or been heavy-handed with enforcement."[43] Some over-simplified interpretation of the policy, represented by the short slogans, shows a distorted understanding of the policy (figure 5.5).

The inspection program added more work burden to local governments, especially to the local EPBs. Besides the tasks of routine work, accommodating the inspection groups from the higher-level senior governments created significant burdens for local governments. A county EPB director noted, "sometimes there are just not enough deputy directors to accompany the inspection groups when the central inspection group, the provincial, and municipal inspections groups are here at the same time". In this circumstance, the ground level implementor may just transit their work focus from implementing policy to coping with inspections from above.

[40] Data source: China energy development report 2018.

[41] New York Times (2018-01-14). Why China's Good Environmental Policies Have Gone Wrong. Accessed on February 1, 2020 from https://www.nytimes.com/2018/01/14/opinion/china-environmental-policies-wrong.html.

[42] Ibid.

[43] Ibid.

Figure 5. 5 Distorted Interpretation of the Policy

Left: Whoever sells coal will be in prison, whoever burns coal will be in prison.
Right: Coal ban is “military order”. If smoke is seen, house will be torn down.
Source: zhihu.com

Scattered coal is definitely a problem that needs to be solved in order to clean up the air. However, what other energy types should be used in each locality, how to achieve the conversion, what is the best timeline, are all critical issues that need to be carefully studied and planned. The fast adoption of the policy deviates implementation from the most effective means to reach the intended goal, which shows the flaw of the “pressurized system”.

The “meeting the deadline” approach may also reveal that officials are more interested in goals that can be achieved through short-term campaign style implementation, than longer term restructuring. It might be necessary to improve the institutional frameworks and standardize technical procedures more to increase the effectiveness of restructuring.

5.3.3 The Progressive and adjustable policy

While the fast and large-scale implementation of the conversion set the momentum, the policy is also under adjustment. After the Strengthened Plan was implemented, a more comprehensive plan, the “Northern China Winter Clean Heating Plan (2017-2021)” was launched in December 2017, by 10 Ministries, including the NDRC, Energy Bureau, and MEP. This plan addresses infrastructure construction, gas supply arrangements, conversion goals, etc. It makes

arrangements to use geothermal, biomass, solar energy, natural gas, electricity, industrial waste heat, and clean coal for winter heating. It requires the clean heating ratio in winter in northern China to reach 50%, and that 74 million tons of scattered coal (including coal used in low efficiency small boiler) should be substituted (replaced) by 2019. By 2021, the ratio should reach 70%, and the coal substitution metric should be 150 million tonnes (165 million tons).

Another comprehensive plan, the Clean Energy Heating Plan for Northern China, was launched in January 2018. This Plan defined the scope of cleaner energy for heating, including, but not limited to natural gas, electricity, geothermal, biomass, solar, industrial residue, and low emission coal. It requires an oversight authority be appointed at each province/municipality/autonomous region, to make provincial level clean energy heating plans that are consistent with local energy, winter heating, and urban-rural development plans. After the plan is submitted to the cross-ministry winter heating coordination office at the national level, which includes the National Development and Reform Commissions (NDRC), Ministry of Housing and Urban-Rural Development (MHURD), Ministry of Finance (MoF) and the Ministry of Ecology and Environment (MEE), each county level government can study and make customized solutions for each place. It set up the goal of a clean energy heating ratio to reach 50% and above for northern Chinese regions, and 90% and above for the “2+26” cities in the air shed, i.e., Beijing, Tianjin, and 26 cities in the Region, by 2021. It specifies high-efficiency heat distribution network, energy-saving house upgrading, pricing arrangements, and the long-term financing solutions involving enterprises, households and the governments.

5.4 Case Findings

The policy at the central government level is more general and provides guidelines for the whole country. Top leaders are trying to effect a *strategic* shift from just focusing on economic growth to achieving both growth and environmental improvement. This change is being driven by a powerful central government. Difficulties in implementation at local levels, such as the complexity of gas-infrastructure installation, the supply of natural gas, and farmers’ ability to afford fuel, etc.,

are often addressed, and frequently solved, by contingent *tactics involving flexible adaptive behavior*. For example, special relationships between the government and SOEs, and personal contacts sometimes were effective.

This campaign style intervention is led by the government, and SOEs and private enterprises are critical to the task, with people as the recipients and beneficiaries, although some people perceive themselves as harmed by the interventions. The government plays a vital role in the policy. Based on the strong leadership, the top-down hierarchical government structure, and the ability to mobilize different levels of cadres, and the up-scaling of the inspection and accountability system, the policy goal has been achieved at a large scale in a timely manner. It benefits the majority of people affected, the environment, and the more powerful stakeholders that are involved. SOEs, such as State Grid, the three major oil companies, and some natural gas companies, and private companies, such as furnace manufacturers and private natural gas companies, have all benefited from the policy. It has also been adjusted over the course of time, more stakeholders have become involved, and the policy has become more comprehensive.

The policy is of high efficiency through the implementation of simultaneous, not sequential actions, which avoided the diversion of goals and the delays that are commonly seen in the Western Implementation practice. It has boosted effective energy consumption levels, and upgraded the composition of energy consumption and infrastructure in northern China. While the government invested the resources, a larger market for cleaner energy, mainly electricity and natural gas, was established. The policy also addressed the imbalance between the urban and peri-urban/rural areas, through more investments in infrastructure, especially in less developed peri-urban/rural areas; meanwhile, pollutant emissions are reduced, and the energy structure is adjusted.

Local governments act fast out of the pressure to meet deadlines, motivated by fear of the inspections. Accordingly, they are left with no time nor motivation to design a customized plan

suitable for local situations. A mechanism that can institutionalize more rational policy translated into planning and technical implementation is needed.

Contrary to the smooth channel from the top to the bottom, there is clearly a missing link in terms of the lack of a bottom - up feedback channel. Local implementors can only passively accept the task and meet the required “evaluation standard”. When it is a political task, it has to be accomplished. Social media may help bring the voice up from the bottom. However, it’s not an “official” channel and it still just represents those who have a stronger voice. More bottom-up channels are needed to give feedback for policy design.

CHAPTER 6

NEW ENERGY VEHICLE POLICY

This chapter focuses on the implementation of China's New Energy Vehicle (NEV) policy. It is a set of proactive industrial policies which serve the strategic goals of economic and technological development for the nation, with environmental goals being part of them, or being one vehicle to assist with achieving the other goals. A coalition is formed top-down, including various levels of government, state-owned and private motor vehicle makers, and consumers as its stakeholders. Through incentives and generous subsidies, a bloated NEV sector has emerged in China, accompanied with cheating scandals, and sales plunged along with the reduction of subsidies. While government intervention, especially the will of the leadership, plays the dominant role in determining the direction of China's NEV industry, market mechanism is used as an important tool to pick the winner and consolidate the industry.

6.1 Background

Vehicle exhaust is increasingly becoming a major source of air pollution in China, especially in large cities such as Beijing. According to a pollutant source apportionment study organized by the Beijing Environmental Protection Bureau and carried out by the Beijing Municipal Environmental Monitoring Center, Beijing University and the China Research Academy of Environmental Science, from 2012 to 2013, the primary source for $PM_{2.5}$ in Beijing is motor vehicles, accounting for 31.3% of locally generated pollution, followed by coal burning and manufacturing. In 2017, the latest pollution source apportionment study shows that mobile pollution source emissions, including motor vehicles and marine vessels, accounted for 45% of the total major air pollutants in Beijing, of which diesel fueled vehicles are the biggest contributor (MEE, 2018). Expanding car ownership, heavy slow-moving traffic, and low-grade gasoline have made motor vehicles the leading source of air pollution in Beijing. Since motor vehicle's exhaust is at ground level and has a positive correlation with population density, its emissions within city limits significantly impact human health (T. Wang, 2014). Besides toxic particulate matters, and its health impact on

humans, combustion of fossil fuel in cars also contributes around 8% of China's total energy related greenhouse gas (GHG), which is an important factor contributing to climate change.

Efforts to reduce pollution from the transportation sector include i) increasing motor vehicle fuel efficiency, such as posing stricter motor vehicle engine emission standards and fuel emission standards, and promoting alternative energy vehicles; ii) improving urban traffic, such as through better public transportation infrastructure and connections; and iii) better spatial plans to reduce commuter travel, such as denser road grids and more mixed-use communities.

Among those policies, promoting alternative energy vehicles, or New Energy Vehicles (NEVs), has been brought to a strategic level. This is because the NEVs not only serve the goals of air pollution reduction and climate change mitigation, but also serve other national goals, including:

(i) serving as a measure to reduce dependency on foreign oil: China is the world's largest oil importer and the second largest oil consumer (EIA, 2018). Sixty five percent of the oil supply in China is imported as of 2016, and this number is predicted to exceed 80% by 2030 (U.S. Department of Commerce, 2017; Q. Wang et al., 2018). Transportation sectors account for nearly 50% of oil consumption in China, of which 80% are burned by motor vehicle engines (Government of PRC, 2016). To accommodate the rapidly growing oil demand, it's imperative that China manufacture and consume automobiles that use alternative sources of energy;

(ii) serving as a way to increase China's competitiveness in the auto sector: In the National medium-to-long term Science and Technology Development Plan (2006-2020), launched by the State Council, NEVs is one of the strategic sectors designated to realize non-dependent (domestic) innovation. China's fossil fuel vehicle sector is not strong. Currently, the automobile sector only accounts for 1.53% of China's total GDP, compared to 4% of leading automobile making countries, such as

Japan and major Western economies. In “Made in China 2025,”[44] published in 2015, NEVs were among the 10 key sectors identified for aggressive development, and is viewed as an opportunity to China to become a world leader in this field;

(iii) serving as the basic unit of smart transportation, and the nexus of renewable energy, smart grids, plus new generation mobile communication and shared transportation. NEVs can leverage the ongoing revolution in energy, information, mobility, and consumption.

The NEV industry promotional policy emerged far earlier than the air pollution issue drew the public’s attention. It became a part of the government’s agenda as early as 2001, the start of the 10th Five-Year Plan period. The Ministry of Science and Technology set up the New Energy Vehicle project in the “National High Technology Research and Development Program”, i.e., the 863 Program, aiming to establish the three ‘‘vertical’’ and three ‘‘horizontal’’ schemes. The ‘‘vertical’’ refers to the Battery Electric Vehicles (BEVs), Plug-in Hybrid Electric Vehicles (PHEVs) and Fuel Cell Vehicles (FCVs), as strategic target products,[45] and the ‘‘horizontal’’ refers to the major technologies related to NEVs, i.e., the vehicle control systems, motor drive systems, and power battery/fuel cell technologies. Spanning three Five-Year Plan periods (10th, 11th and 12th), the 863 NEV Program provided a total of 2 billion yuan to support the research efforts by Chinese car manufacturers, universities, and research institutes (X. Cao, 2018). Most of the leading Chinese automobile companies that entered the NEV industry in this period received support from the Program (Liu & Kokko, 2013).

[44] “Made in China 2025” is the Chinese government’s strategic plan on upgrading China’s low-end manufacturing to be at the top of global production chains. After its launch in 2015, it caused fears in some high-income, developed countries such as United States, that China is to become a major competitor in advanced manufacturing.

[45] These three electric vehicle products comprise all the types in the NEVs category, as was later defined in the “Energy Saving and New Energy Vehicle Industry Plan” published in 2012, which refers to NEV as “vehicles with new-type power systems, completely or mainly driven by new energy sources”.

Thanks to the support of the national program, in 2006 and 2007, domestic car makers were able to make all three types of automobiles in the ‘‘vertical’’ theme. During the 2008 Beijing Olympic Games, about 500 NEVs were used to service the Olympic park area, as a showcase of the NEVs development level and an operational test. The Ministry of Science & Technology organized car makers to provide those vehicles for the Olympics.

China’s NEVs policy showed two divided phases by the year 2009. Before 2009, it mainly focused on government-led Research and Development (R&D); launched in 2009, the “ten cities, one thousand cars” program set forth the commercialization of China’s NEV. When the Chinese government decided to pour 4 trillion into its economy stimulation plan to cope with the 2008 financial crisis, NEV was set by the State Council of PRC as one of the seven new pillar industries to upgrade the economic structure, and was listed as one of the key fields to be promoted in the 12th five-year Plan on Science and Technology Development. To promote the NEV industry, various plans and programs were set up with the target of mass adoption in the consumer market (see Appendix B). Among them, the most important and strategic ones include:

(i) In 2012, the “Energy Saving and New Energy Vehicle Industry Plan” issued in 2012 by the State Council represents the top political leadership’s expectation regarding China’s auto industry development. This plan specified the following goals for China’s NEV commercialization:

- By 2020, the production capacity of BEV and PHEV shall reach 2 million, and the accumulated sales of those two types of NEVs shall reach 5 million.
- The development level of FCV and hydrogen for cars shall be at the forefront of development world-wide.

(ii) In 2017, the Auto Industry medium-to-long-term Development Plan set the targets for promoting NEVs to leverage a greener auto industry. According to this plan, by 2025,

the ratio of NEVs sales as a share of total auto sales shall exceed 20%, and the corporate average fuel consumption (CAFC) of new passenger cars shall be 5.0 L/100 km in 2020 and 4.0 L/100 km in 2025. This CAFC goal is hard to achieve by just improving the internal combustion engine efficiency of traditional cars, thus it will force traditional auto manufacturers to make sizeable numbers of NEVs models, too.

(iii) Beside the NEVs sector development plans, environmental plans have referred to NEVs as an important air pollution policy, which supported and endorsed the promotional actions for NEVs. The “Air Pollution Prevention and Control Plan (2013-2017)” specified that new energy vehicles are an important air pollution control measure. It stated that buses, sanitation vehicles and government departments should take the initiative to use NEVs, and that cities such as Beijing, Shanghai and Guangzhou shall have at least 60% NEVs in additions to their bus fleets. In 2018, the “Blue Sky Battle Three-year Action Plan”, which is a continuation of “Air Pollution Prevention and Control Plan (2013-2017)”, echoes the goal in the “Energy Saving and New Energy Vehicle Industry Plan” issued in 2012, i.e., 2 million NEVs sales in 2020. Provinces and municipalities also launched NEVs promotional policies in their environmental protection plans.

A string of policies has been launched around those comprehensive plans to promote the NEV industry, either to supplement the policy with implementation programs and financial resource allocation, or to modify the policy as flexible responses to different implementation stages, market conditions and technology levels. Measures proposed in those documents include improving technology in the vehicles and batteries, the construction of the charging infrastructure, recycling of batteries, fiscal and taxation support, and purchasing subsidies, etc. The policy focuses on stimulating market demand and improving the vehicles’ technological level. Table 6.1 listed the government documents that are relevant to the NEV policies since 2009. The evaluation of NEV policy focuses on the period from 2009 onwards, until the end of 2019.

6.2 Implementation Description & Assessment

6.2.1 What happened

China's NEV commercialization started with the "ten cities, one thousand cars" program launched in 2009, which planned to set up ten pilot cities each year, for three consecutive years, to adopt a thousand NEVs in each city.[46] Four ministerial authorities were in charge of this program: The Ministry of Science and Technology (MoST), Ministry of Finance (MoF), National Development and Reform Commission (NDRC), and Ministry of Industry and Information Technology (MIIT). At this early stage of commercialization, the government created demand through mobilizing other public actors, such as state-owned car manufacturers and local governments, to produce and procure government and public use vehicles. NEVs were used in public services such as buses, taxis, government cars, sanitation and postal vehicles.

This subsidy-based approach motived local governments to apply for pilot projects. 25 cities were selected in this three-year program, five of which also set up subsidy regimes to incentivize individuals purchasing passenger cars. By the end of 2012, a total of 27,432 NEVs were purchased in those cities, of which 84% were used in the public sector. However, except for Beijing and Shanghai, where the municipal governments have the financial resources to purchase NEVs and have opportunities to use large-scale events to deploy them, e.g., the Beijing Olympic Games 2008 and the Shanghai EXPO 2010, the other 23 cities couldn't achieve the 1000 cars goal. An evaluation report by the MoST, when analyzing the causes of unsatisfactory outcome of the pilot project, listed barriers including insufficient production capacity, car performance unable to meet consumer demand, and local protectionism. Among those factors, poor battery performance is the bottleneck to improve the NEV's general performance.

Upon the closure of the "ten cities, one thousand cars" program, a new round of pilot projects unfolded in 2013.[47] In the following two years, 88 cities had gained the pilot title. With the

[46] Government document number: MoF [2009] 6.
[47] Government document number: MoF [2013] 551.

completion of the second-round pilot projects, started the third round of NEVs promotion in 2016, with its scope extended to the whole nation.[48]

Accompanied with the expansion of NEV market is the decline of government subsidies. The four ministries have mentioned in a circular published in 2013 that the subsidies will gradually be reduced. In December 2016, a 20% reduction of the subsidy standards and an upper limit were specified;[49] meanwhile, the local matching subsidy[50] was required to reduce from 1:1 to 50% of the central government's subsidy, or lower. Each year after that, the four ministries launched a circular to further lower and restrict the fiscal subsidies. Higher mileage and higher battery energy density (energy per kilogram of battery) were encouraged, while subsidies for low mileage vehicles were eliminated in 2018 (see Table 6.2 for national subsidy standards comparison in 2016-2019). According to the subsidy standards, in 2016, buyers of NEVs could receive up to a total of 110,000 yuan national and local subsidies per car; in 2018, this number reduced to 75,000 yuan per car; it was further cut to 25,000 yuan in January 2019, and will end in 2020.

Table 6. 1 National subsidy standards (thousand yuan) for purchasing NEVs

Driving Distance per Charge (km)	2016	2017	2018	2019
100-150*	25	20	0	0
150-200	45	36	15	0
200-250			24	0
250-300	55	44	34	18
300-400			45	18
Above 400			50	25
PHEV >50km	30	24	22	10
FCV, passenger car	200	200	200	200

Source: circulars on financial subsidy policy to promote NEVs adoption by MOF, MIIT, MOST and NDRC.

Now examine the data of China's NEV sales over the years. In 2011, the total sales of NEVs in China was just 8,159. The years of 2014 and 2015 saw a surge of the market, with growth rates

[48] Government document number: MoF [2015] 134.
[49] Government document number: MoF [2016] 958.
[50] The local matching subsidy is the subsidy given to the NEV makers by the municipal government, on top of the subsidy from the national government. In 2016 and 2017, most cities provide subsidy which equals the amount of the national subsidy. In 2018, the matching subsidy in many cities reduced to half of the national level, and to zero in 2019.

over 300% (Figure 6.1). In 2015, the annual sales of NEVs reached 331,029, surpassing that of the US (Figure 6.2); China became the number one in NEV sales in the world.

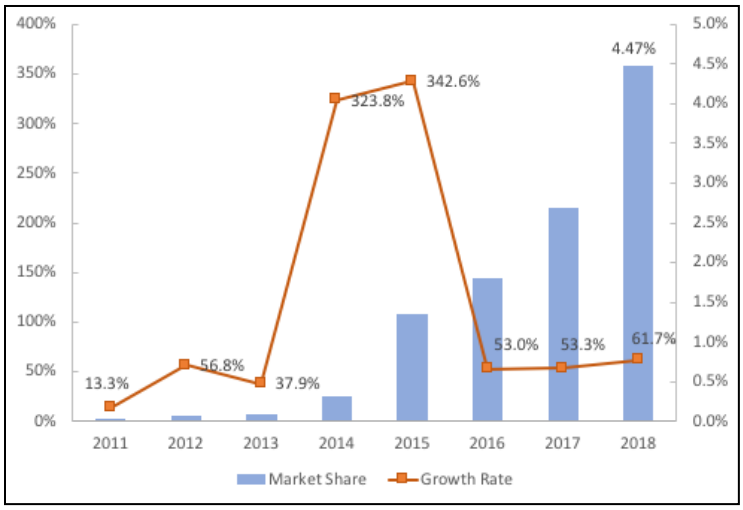

Figure 6. 1 China's NEVs Market Share and Growth Rate (2011-2018)

Data source: China Automobile Industry Association.

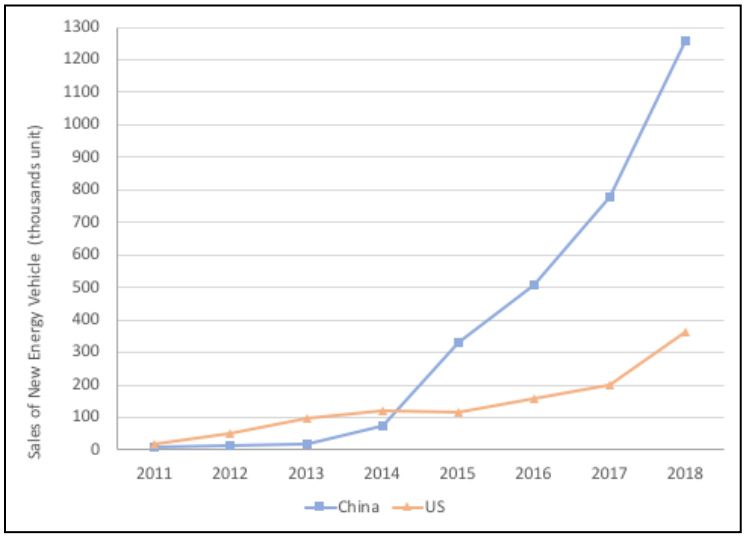

Figure 6. 2 NEV sales in China and the US (2011-2018)

Data source: China Automobile Industry Association, Inside EVs.

In 2018, when China's auto market sales decreased for the first time after 28 years of increase, NEVs sale reached 1.26 million, a 61.7% increase compared to 2017 (Figure 6.2). NEVs accounted for 4.47% of China's total vehicle sales, while US NEV sales account for less than 2% of total sales. By the end of 2018, the cumulative number of NEVs sales around the globe was 5.5 million, with China accounting for more than 53% of global sales. As per Roland Berger's E-mobility Indices 2018, which compared NEV development in seven leading automotive nations, China ranked number one in both industry index, i.e., value added in terms of vehicle assembly and battery production, and market index, i.e., the EV/PHEVs' share of the overall vehicle market. However, for the technology index, China only ranked sixth, after France, Germany, Korea, Japan, and the United States.

While it seemed that China's NEV policy had created a success story, when it came to the second half of 2019, the story turns. Starting from July 2019, sales data began to plummet; as of the end of November, the production and sales of new energy vehicles have experienced declines for five consecutive months. This decline, in terms of timing, coincides perfectly with the official cancellation of the subsidies on June 25, 2019 (there was a three-months buffer period starting from March 25 when the government circular on the subsidy adjustment for 2019 was effective). Arguably, there are other factors affecting NEV sales. One is the announcement of earlier adoption of the "China VI" vehicle emission standards than planned. Starting from July 1, 2019, sales and registrations of new vehicles in regions including Beijing, Shanghai, Tianjin, Hebei province and Guangdong province must comply with the "China VI" standards. Due to this, vehicles meeting the "China V" emission standards were heavily discounted, which adversely affected the sales of similar class NEVs. Another factor might be the slowing down of the whole economy, which has been reflected in various fields of consumption, such as the decrease of conventional vehicle sales. In addition, media reports on quality issues such as electric vehicle fire incidents, and low residual values also discouraged consumers from purchasing NEVs. But nevertheless, the dependency of China's NEV on the subsidy is obvious. After a sharp increase

of sales in June before the subsidy was cancelled, NEV sales couldn't catch up with the achievement it had in 2018.

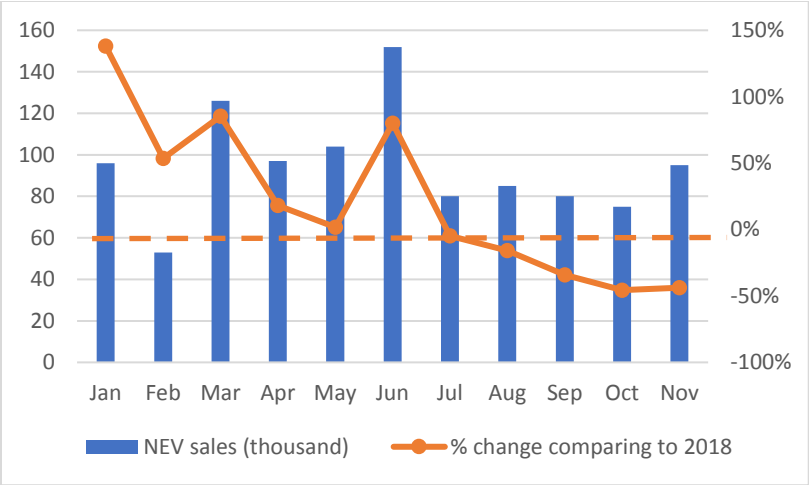

Figure 6. 3 NEV Sales by Month in 2019 and Comparison with 2018

Data source: China Automobile Industry Association

Accompanied with the receding "carrots" of government subsidies, is the befalling of the "stick". The "dual-credits" policy[51] came into effect in 2018, making NEVs production and sales compulsory for automakers. This policy is composed of two limits: *firstly*, a stringent corporate average fuel consumption (CAFC) is required for improving fuel efficiency. CAFC should achieve 5L/100km by 2020 and 4.5L/100km by 2025. The CAFC goal is for the whole product line, but it is difficult to achieve by just improving internal combustion engines without producing NEVs; *secondly*, it requires medium and large scale automakers (those who sell at least 30,000 conventional fuel vehicles annually) to gain NEV credits for 10% and 12% of conventional fuel vehicle production in 2019 and 2020 respectively (art. 17). Each conventional fuel vehicle that doesn't comply with the CAFC standards may generate negative credits, depending on the difference from compliance value; Each NEV sold may generate positive credits, such that each

[51] The government order which contains this policy is "Measures on Parallel Administration of Passenger Car Enterprise Average Fuel Consumption and New Energy Vehicle Credits". It was launched in 2017, and went into effect starting from April 1, 2018.

plug-in hybrid accounts for two credits, pure electric cars generate credits depending on their electric range, and fuel-cell cars generate credits depending on the rated power of their fuel cell systems (Annex II.). Automakers with negative total credit at the end of the year need to purchase credits from others who have surplus credits. The stringent NEV credit and CAFC requirements make it almost impossible for a carmaker to comply if it does not make NEVs. Due to China's large market and the dual-credit policy, many conventional fuel vehicle makers, including joint-ventures and foreign companies, are modifying their global strategies and are starting to develop NEV models or expand the number of models they produce.[52]

With the good intention to both improve the conventional fuel vehicle efficiency and promote NEV production, the "dual-credits" policy was proven to be problematic in implementation. The accounting result of the 2018 credits by the four ministries[53] shows: i) compared to 2017, the negative credits generated from noncompliance with CAFC has increased, and the ratio of complying enterprises has decreased by ten percentage points – a sign that enterprises weren't motivated to improve the conventional fuel vehicle's fuel efficiency; ii) the NEV generating positive credits has increased so much that after offsetting the negative credits, the surplus was almost 11 times of that in 2017 - which caused an imbalanced market for credit trading.

To address the unexpected distortion in the implementation, the four ministries published an amendment to the "dual credits" policy and requested feedback, just a few days after the accounting results were revealed. The major amendments included: i) decreasing the credits the production of each NEV could generate; ii) increasing the threshold of obtaining NEV positive credits. The focus will be more on the performance such as battery efficiency (power usage per mile driven), less on the mileage after one charge, which has led automakers to install additional

[52] Keith Bradsher, "China Hastens A Global Move to Electric Cars," New York Times, October 10, 2017, https:// www.nytimes.com/2017/10/09/business/china-hastens-the-world-toward-an-electric-car-future.html

[53] Xinhuanet.com. (2019-07-24). Credits per NEV decrease, and threshold to obtain credits increases in the dual-credits policy adjustment. Accessed on February 1, 2020 from http://www.xinhuanet.com/auto/2019-07/24/c_1124790903.htm.

batteries but considering less the performance and safety of the vehicles; iii) the calculation of CAFC will exclude the NEV, which will force automakers to pay attention to the conventional fuel vehicle efficiency.

This transitioning to a more market-oriented approach to increase fuel efficiency and mandating NEV production indicates that the central decision makers believe it is time to let the market pick the winners, after a decade's cultivation of the industry and the market with pouring financial resources into it. China will scrap the foreign ownership cap of 50% on joint-venture car makers by 2022, to remove the barrier for free competition. In fact, the cap has been removed for NEVs since 2018. In 2019, NDRC issued a provision on the administration of investment in the automotive industry, in which it allows all-foreign owned NEV firms to operate in China. Tesla is the one direct beneficiary of this policy change. With support from the Chinese government,[54] it took just one year for Tesla's first overseas factory, Gigafactory 3, to go from breaking ground to delivering its first China-made car. The introduction of domestically made Teslas is expected to induce the catfish effect – killing a bunch of NEV makers and make whatever left stronger. It's also expected that Tesla will boost the production chain of NEVs. Due to the time constraints of getting the new cars onto the market, Tesla's Shanghai factory only used 30% of domestic parts in 2019, but this ratio is expected to reach 70% in mid-2020, and 100% by the end of 2020.

6.2.2 Implementation assessment

Stakeholders

The implementation of China's NEV policy involves vast number of stakeholders. The main categories include: central government, local government, automotive enterprises (including car

[54] Support from the Chinese government includes both policy and State-Owned banks loans. Tesla filed on the exact day when the provision was issued by NDRC and obtained the license for producing passenger cars from MIIT within just ten months. Some Chinese NEV firms, such as Nio and Xpeng, which were founded in 2014, haven't obtained this license, and are still manufacturing through OEMs of conventional fuel automakers. Tesla was granted loans totaling 13.5 billion yuan from several state-owned banks, with a 10% lower than average interest rate. In addition, Tesla electric cars also qualify for subsidies.

making SOEs, private car makers, and foreign car makers), tech companies, car parts enterprises (such as battery manufacturers), and consumers. Figure 6.4 shows the relationships among those stakeholders.

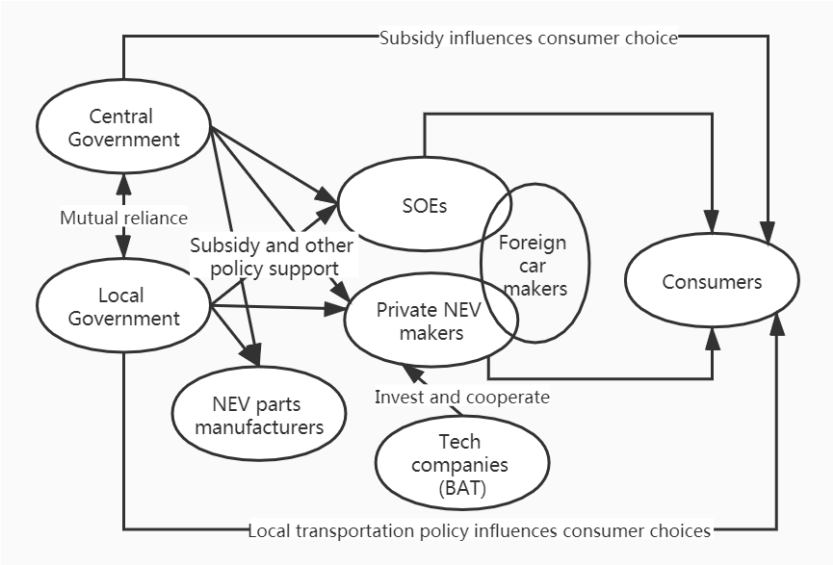

Figure 6. 4 NEV Stakeholders and Their Relationships

Source: the author.

(i) The central government has been taking the lead to promote China's NEVs industry. As mentioned before, the administration of the NEVs industrial promotion is through the four major competent authorities, i.e., the MoST, MoF, NDRC and MIIT. Their involvement is positive in ensuring implementation of policies necessary to include the NEVs industry's vision, roadmap, regulations and financial support. To carry out this national strategy, public sector stakeholders were the first being mobilized. The initial R&D was funded by the central government to support research by institutes affiliated with relevant ministries and car making SOEs. The initial commercialization was through mobilizing public sector actors. In the two rounds of "ten cities, thousand cars" programs, pilot cities were generously subsidized in the procurement of their NEV public fleets, with funding from both the central government and counterparts in the local governments.

(ii) Local government is an important implementor of the NEV policy. For cities, economic vitality is one of the most reliable indicators for evaluating the local cadre's performance. Thus, local governments are in a nation-wide competition and they are constantly seeking out new growth points to stay economically competitive. NEVs, as a national strategic industry, can bring in central government subsidies in the short term, and industrial upgrades and job opportunities for the local economy in the longer run. The development of this industry means more government revenue, and better chances for officials to be promoted. It is undeniably welcome at the local level. Not only that, these initiatives also align with the more and more stringent air pollution reduction mandates from the central government. Thus, recognition of local governments and cadres is achieved both in terms of potential economic growth and potential environmental improvement – a double win rather than a tradeoff between these two priority contemporary goals of Chinese governance. It aligns perfectly with the practice of president Xi's ecological civilization ideology, and satisfies the growing demand from the public for a better environment. In this industrial promotion initiative, the national and the local governments are in a relationship of mutual co-reliance. The national government's goal is to advance the nation's auto industry to a "fast lane". To realize this goal, it has to rely on implementation at the local level. Pilot cities are a common approach for the central government to pass down such initiatives. For cities, attracting a pilot title is like holding a ticket to enter a club where they can obtain the central government's subsidies, which benefits their existing car industry and attracts carmakers from other cities to set up branches in their jurisdiction.

(iii) SOEs is another major implementor of the NEV policy. As the central government seeks industrial and technological advancement, and local governments seek local revenue increase and recognition from the central government, enterprises on the NEV production chain are seeking profit. The SOEs operate on state-owned capital, and they have an innate advantage in getting government funding. The State-owned Assets Supervision and Administration Commission (SASAC) is the special ministerial level institution directly under the management of the State Council. It supervises and manages State-owned assets of centrally administrated

SOEs through performing the investor's role on behalf of the State Council. Under its supervision, in 2010, the State-Owned Enterprise Electric Vehicle Industry Alliance was established, comprising 16 centrally administrated SOEs in areas related to the NEVs ecosystem. The SOEs alliance was established at a time when the Energy Saving and New Energy Vehicles Industry Development Plan draft was submitted to the State Council for approval, thus it was viewed as a way to seize the national investment proposed in the plan.[55]

(iv) Private sector actors have been actively participating in this campaign. Their motivation is two-fold. One is to take advantage of the demand-side policies, i.e., government providing subsidies to buy cars; the other one is to make better products and expand their businesses. Well-established private automakers, such as BYD, have been expanding their factories to more than ten cities in China, and have set up manufacturing base overseas, in California.[56] Start-up NEV companies, which are called the "car making new force", such as Nio, Xpeng, and Byton, have launched new NEV models. The national NEV monitoring and management platform[57] shows there were more than 400 companies that produce NEV in China in 2018. Many of them are set up to receive government subsidies.

(v) Major foreign enterprises try to expand their share in the Chinese NEV market. Major international automakers, including ABB, and Japanese ones, such as Honda and Toyota, have been releasing electric car models for the Chinese market. Meanwhile, the policy obstacles towards foreign automakers are loosening up. In 2018, the ratio of foreign shares in NEV manufacturing must be less than 50% has been lifted. While welcoming foreign capital to invest in China and help to integrate the NEV supply chain, the emphasis from the Chinese government is

[55] China Energy Network. (2010-08-25). Sixteen SOEs are after the thousand billion yuan financial support for NEV industry, and their alliance is criticized as a monopoly. Accessed on February 1, 2020 from https://www.china5e.com/news/news-123296-1.html.

[56] Industry Week. (2013-05-06). First US Manufacturing Plants for Chinese Bus Company. Accessed on February 1, 2020 from https://www.industryweek.com/expansion-management/first-us-manufacturing-plants-chinese-bus-company.

[57] The national NEV monitoring and management platform's website is www.evsmc.org.

to strengthen basic manufacturing capacity, which includes core parts, technique, material and technology. For example, the Made in China 2025 calls for at least 70% of the key parts be provided by domestic companies by 2025.

(vi) Vehicle electrification has a synergy with another two currently hot innovation fields: autonomous driving and ride-sharing. Compared to conventional fuel vehicles, NEV has some advantages in merging with those two fields. Its vehicle control system is much simpler than an internal combustion engine, and the people who are developing the two technologies know less about the conventional fuel vehicle's system; the structure of NEV is easier to alter to accommodate compared to the matured conventional fuel vehicle; the two added technologies will demand high electricity usage since it is not efficient nor economical for conventional fuel vehicles to generate electricity from its fuel. The three internet giants in China, Baidu, Alibaba and Tencent (BAT), car-sharing and ride-hailing companies, such as Didichuxing, have embraced the national "Internet Plus Strategy" and teamed up with car making companies to add information technology to NEVs. This has allowed their customers to utilize their hand-held technology with their new vehicles. Baidu's autonomous driving program, Apollo, has reached strategic cooperation with BAIC. Alibaba has cooperated with SAIC to develop the car model Roewe, with Alibaba's YunOS operational system installed. Tencent has cooperated with GAC to produce the car model iSPACE, which runs Tencent's "AI in car" system. Besides being practitioners in this synergy, they also act as investors to have a share in the above-mentioned start-up car making companies. Baidu has invested in "car making new force" companies such as Nio and Weltmeister, while Alibaba has invested in Xpeng Motors, and Tencent has invested Nio, Weltmeister and Tesla. Cooperation among those actors is becoming more intense, this kind of consolidation and strategic collaboration is being encouraged by the government. NDRC and MIIT have launched circulars to encourage these automobile alliances and the merging of related companies.

(vii) Enterprises on NEV's supply chain of NEV also benefited from the policy. On the central government's automobile industry development roadmap of "switching to the fast lane", strengthening the supply chain is an essential component. There are over 13,000 auto suppliers in China who are capable of providing all of the components needed by passenger vehicles. The strong incentives to develop NEVs have resulted in spill-over benefits to all the links of the production chain, and resulted in increased supply chain integration. Take the most important component of a NEV, the battery, for example, domestic battery makers received a rapid boost. A "white list" of batteries issued by the Ministry of Industry and Information Technology (MIIT) in 2015 has excluded foreign battery makers from subsidies. In 2016, China's lithium-ion battery production accounted for about a quarter of the global supply (Hertzke et al., 2017). In 2018, CATL and BYD were listed in the top 5 Lithium ion battery producers by capacity in the world, together with LG Chem, Panasonic and Tesla.[58] Although being the biggest car battery producer in China, and although they have been expanding their capacity, CATL still need to catch up with the battery industry's tier one suppliers, such as Panasonic, Samsung SDI, and LG Chem, in terms of quality. In the middle of 2019, MIIT scrapped the "white list" for battery producers, which now allows for Japanese and Korean battery makers to compete with equal footing in the Chinese market.

(viii) Consumers are an essential part of the NEV industry. However, the big drop in NEV sales in 2019 subsidy suggests demand for the NEV is not strong unless the government is taking a big part. Moreover, only 30% of the NEV sold in China were purchased by individual consumers, while the rest are by taxi or ride-hailing companies and government-related fleets.[59] Based on my interviews with NEV owners and NEV sales managers, the main factors impacting their decisions of choosing NEV include: more economical in maintenance and operation, and more

[58] Data source: Benchmark Mineral Intelligence.

[59] Jacky Wong, A Bumpy Road for Electric Vehicles in China. (2019-12-05). In the Wall Street Journal. Access on January 23, 2020 from https://www.wsj.com/articles/a-bumpy-road-for-electric-vehicles-in-china-11575546442.

environmentally friendly comparing to conventional fuel vehicles, state subsidies, and easier-to-obtain car license plate in cities where there are quotas for conventional fuel vehicles.

The NEVs coalition is a growing network of politicians in the central government and its departments, city mayors, SOE leaderships, private-sector entrepreneurs, R&D institutions and consumers. They are increasingly expanding connections amongst each other and working together to overhaul China's NEVs industry. The coalition is formed in a top-down pattern. This is unlike what is seen in democratic systems. For example, the Dutch Sustainable Growth Coalition was initiated by eight of the largest companies in the Netherlands. They engage in active dialogue with government ministers with the aim of making environmental and social progress which can benefit the nation and their own profitability.[60]

One problem with the top-down coalition is that the policies inevitably favor SOEs. The State-Owned Enterprise Electric Vehicle Industry Alliance established at the beginning of the NEVs commercialization has just SOEs members. Those private sector actors who have been actively putting resources into R&D, such as Chery and BYD, were excluded from the Alliance. While the evaluation standards by SOEs' administrative authority, the SASAC, is focusing on the preservation and appreciation of the state capital, the SOEs have little incentive to invest big money in NEVs R&D, which may not be profitable in the short term. In fact, BYD as a private firm, ranked second in number of NEVs sold worldwide, only after Tesla.

Accountability mechanism

As with many other policies in China, an accountability mechanism is also used by the central government to press and monitor the local governments to implement the NEVs promotional policy. The pilot cities, when receiving the status titles and subsidies from the central government, also bear the responsibility to accomplish the assigned tasks. The first two rounds of NEVs pilot

[60] Andrew Steer. (2018-12-05). How China Raised the Stakes for Electric Vehicles. Accessed on February 1, 2020 from https://www.weforum.org/agenda/2018/12/how-china-raised-the-stakes-for-electric-vehicles.

cities program have set goals and laid out evaluation measures. As per the “Circular on Continuing the Promotion of NEV Adoption” (MoF [2013]551), if a city doesn’t meet the goals, it will be eliminated from the list and the title and the subsidies will be canceled.

Even with this accountability mechanism, the outcome of the two rounds of pilot projects was disappointing. At the end of 2011, the first round of the 25 pilot cities only accomplished 38% of the planned 25,000 NEVs adoption (Li, 2012). There were 14 cities which adopted less than 30% of their goals. On the other hand, the central government departments may have expected such an outcome. During the initial commercialization stage, the promotional policy wasn’t substantial enough to produce the desired effect. On the supply side, the essential technology, including the core part, battery, for NEVs wasn’t well developed, and automobile manufacturers couldn’t reach the desired scale of production in such a short span of time. Thus, the subsidies had limited effect on increasing supply productivity. On the demand side, the consumption market wasn’t ready for this new product yet. There was a much lower demand for NEVs compared to that of conventional fuel vehicles. The charging infrastructure and product performance were not satisfactory, but they are important factors that impact consumer decisions. Thus, the subsidies didn’t affect sales much. The central government understood the situation, and when it was supposed to do the mid-term evaluation for the second round of pilot projects at the end of 2014, it delayed it to mid-2015 to give cities more time to prepare. Even with this delay, almost half of the 88 pilot cities adopted zero NEVs, and 33 cities even didn’t have any relevant policies launched to promote the adoption of NEVs. The central government had planned to not conduct pilot projects in 2016, but will select cities with good performance to give awards.

The accountability mechanism wasn’t as strict as some other environmental indicators, such as days of compliance, or the amount of pollutants reduced. This is partially because the indicators used to evaluate the NEVs adoption are not binding. In China’s planning system, there are usually two types of indicators: binding indicators and expected indicators. Binding indicators are usually those in the public service sectors, where it requires the government to designate public

resources and use administrative tools to ensure the goals to be met. Expected indicators are usually desired achievement levels, and are usually concentrated in economic and technological fields. For those indicators, the government's responsibility is to adopt proper financial, industrial, and investment policies to create better institutional and market environments, and to let the market work in its own way to achieve those goals. Binding and expected indicators represent the field where the government and the market, respectively, should take the lead, and reveals the relationship of the two in China's planning system.

The accountability mechanism for the NEVs pilot projects is more of rewarding the winner than punishing the loser. Despite the initial difficulties in promoting NEVs, and the poor outcomes in some cities, there are several cities which have done well. In 2017, all 16,000 buses in Shenzhen were electric vehicles, which made it the first city in the world to have an entirely electric bus fleet. Beijing has 15,000 NEV buses, which accounts for 65.5% of its bus fleet. In 2016, all taxis in Taiyuan city are electric, which made it the first city in the world to have an all-electric taxi fleet. Cities have different capacities, but nevertheless, a prosperous NEV industry in a city shows the competence of the cadres. The evaluation system for local cadres is based on the performance of local social and economic development, the successful promotion of NEVs would have a positive effect on their career.

With the more comprehensive NEV policies, the government is transitioning its measures to be more market-oriented. The reduction of subsidies and the "dual-credit" policy are gradually making the true market entity, the enterprises, to be accountable for improving technology, lowering manufacturing costs, and making NEVs to meet the credit requirements. But due to the flawed design of market-oriented policy, the credit requirements do not necessarily reflect the consumer requirements.

Flexibility

The flexibility of China's NEV policy is demonstrated by the fusion of government planning and market mechanism. The policy focuses and tools have been adjusting swiftly to realize new period-based goals for the general strategy: massive government investment was poured in at the earlier R&D stage. At the initial commercialization stage, it was reasonable to start adoption in high-mileage driving vehicles, given that NEVs come with a higher purchasing price but cost less to run. In the first round of pilot city program, public procurement is a primary tool. The ones to be subsidized were the bus fleets and government vehicles, logistics vehicles, taxis, ride-hailing cars and car sharing businesses. Then the privately-owned passenger cars were subsidized, to cultivate a market for the NEVs. Starting from the second round of the pilot program, there was a sharp increase in the number and comprehensiveness of national and local policies to cultivate and promote the NEV industry, which contributed greatly to the boom of NEVs production in China. The focuses of incentives transitioned from public to private vehicles, and from accelerating production expansion to stimulating consumption. Direct incentives include initial purchasing tax exemptions, private charging slot installation subsidies, vehicle and vessel tax exemptions, favorable parking fees, license fees, and insurance fees, etc. Indirect incentives include subsidies on public charging infrastructure construction, driving privileges (bypassing the lottery or auction procedure to obtain a license plate if purchasing an NEV), etc.

When the volume of the production and sales achieved a certain scale, it was time to let the market improve efficiency. The policy shifted to a more market-oriented direction. Buyer subsidies were dramatically reduced on short notice - a three-month buffer time for the subsidies to be cut in half. Mandated NEV credits, stricter fuel efficiency requirements, and relaxation of foreign capital caps of joint ventures: all of those policies have shown the central government's determination to weed out the losers in the game. Then, the focus of the policies turned to the supporting environment for NEVs, including the improvement of the infrastructure and management systems, such as improving the charging infrastructure, recycling of batteries, facilitating second-hand markets, insurance, optimizing data and network management, and

improving sectoral regulations and standards. To conform with the expected proliferation of autonomous vehicles and car sharing, R&D focused on intelligent and automated vehicles and autonomy technology will be increased. The building of an innovation platform and facilitating strategic alliances for the synergy of NEVs with smart grid, new energy, energy storage technologies are also promoted. Those policies, together signaled the central government's determination to create a sounder market, significantly improving the supporting operational environment, and upgrading the technological level for NEVs.

The policy also welcomes more market elements to increase competition and improve efficiency. Private investment in charging stations is encouraged. Areas lacking charging facilities have been quickly disappearing. By the end of 2019, the number of public charging stations in China has reached 516,000, of which 70% are private investment. In this charging network, State Grid, the biggest electricity operation SOE,[61] has built and is operating 88 thousand charging stations, ranking number three, after two private companies, Told (152 thousand) and Starcharge (130 thousand). State Grid also provides connecting service to charging stations built by private companies.

The introduction of market competition for NEVs is built on previous lessons learned from conventional fuel vehicle policy. In the 1980s, the State Council decided to establish a few car SOE manufacturing bases, and only permit them to produce cars, to reduce superfluous investment.[62] During the same period, in order to upgrade the technology of passenger cars, with the hope of creating a "market for technology", the Chinese government adopted the joint-venture strategy to allow foreign car makers to cooperate with Chinese firms. The policy rendered two notable effects: i) private enterprises were blocked from entering the industry by this policy barrier, and missed development opportunities; and ii) the designated automobile manufacturing

[61] There are two Grid corporations in China, i.e., State Grid and China Southern Power Grid. Both are SOEs.

[62] This decision was specified in the Circular on Strictly Restricting Passenger Car Production Sites issued by the State Council in 1988.

sites gained a de facto government-granted monopoly. The technology was under the control of foreign investors, and SOEs in the joint venture had little incentive to invest in R&D, but prolonged the existing models' life cycle for maximizing profit, which slowed down the technological innovation and advancement. Although the joint-venture received high privileges, Chinese private automakers, such as BYD and Geely, outperformed the SOE joint-ventures after they finally acquired licenses through purchasing local government owned automakers and lobbying to enter the industry (Kennedy, 2018).

When it comes to the NEV policy, overcapacity is inevitable. Although there are many and dispersed NEV manufacturers, it might be a cost the Chinese government is willing to pay to make a few points of excellence stand out in the competition. In fact, when the NEV policy was designed, the discussion included important lessons from the conventional cars policy. The following is quoted from an interview[63] with Mr. Chen Qingtai by Caixin.com, President of China Committee of Electric Vehicles 100 Members (China EV100); former Party Secretary and Deputy Director, Development Research Center of the State Council:

> "It's understandable that we try to prevent repeated investment and the waste of resources, but that is the mentality of the planned economy. In 2010, when we were making the NEVs development strategy, some were proposing to designate 'leading enterprises' to carry out the development plan and not allow many to rush into this field. I opposed it, claiming things will go contrary to the planned goals if we do so.
>
> When a new technology starts to commercialize, many investors see the potential, so they step into the field and put in their capital. Due to the uncertainty of the new industry, it's hard for the government to pick out the winners at that stage. What is needed from

[63] The interview minutes can be found at: Wang Binbin, Li Xiyin. China's NEVs industry: on the crossroad of policy and market, interview to Chen Qingtai. (2019-02-03). In Caijing.com. Accessed on May 23, 2019 from https://news.caijingmobile.com/article/detail/383758?source_id=40.

> the government is to accelerate the trial and error process. Investors use their own money to share the risk and cost of trial and error, and this should be welcomed. Most will fail but they contribute to the final success. Actually, most investors are prepared for that consequence."

Mr. Chen is logical in welcoming the competition. However, the fusion of government intervention and market competition formed a paradox which in fact distorted the market. Although the central and local subsidies helped with rapid commercialization, the large number of pilot cities and the huge amount government funding distorted the market and dispersed the financial resources in developing the NEV industry. Especially when powerful interest group, such as the SOE alliance seize the resources, it set up barriers which restrict and limit competition from private sector actors.

In addition to the sequential policy and the adjustment of tactics at appropriate stages, the technological path also went through flexible changes. At an early R&D stage in the 1980s, when the 863 Program was launched, the policy was relatively evenly balanced vis-a-vis all three types of NEVs technologies. With time, Battery Electric Vehicle (BEV)-led electrification was set forth as the development strategy in the 863 NEVs Program during the 12th Five-Year Plan (2011-2015) period, based on China's comparative advantage in battery technology. The 13th Five-Year Plan (2016-2020) represents a continuation of that strategy. It aims to promote the commercialization of Battery Electric Vehicles (BEVs) and PHEVs further, to increase the competitiveness of battery supply chains, and promote the R&D of Fuel Cell Vehicles (FCV) and its commercialization. However, FCVs had not received as much attention as BEVs, until Premier Li Keqiang's visit to Toyota's factory during his visit to Japan in 2018. It triggered a shift in China's NEVs technological path.[64] Li saw that Toyota's FCV model Mirai had a 650-kilometer driving range,

[64] Epoch Times. (2019-04-12). China's Electric Vehicle Industry Hit Hard by Policy Shift as Beijing Turns Toward Hydrogen Fuel. Accessed on May 26, 2019 from https://www.theepochtimes.com/chinas-electric-vehicle-industry-hit-hard-by-sudden-policy-shift-as-beijing-turns-toward-hydrogen-fuel_2865743.html

was already in its second generation, and at the mass production stage. After his return, a team was quickly assembled by several ministries and commissions to develop hydrogen fuel-cell technology. Later in the year, the former Minister of MOST, Wan Gang, published an article on the *Peoples' Daily*, the mouthpiece of the CPC, to promote the advantages of FCV[65]. In the 2019 Government Work Report, the development of hydrogen stations for FCVs was included for the first time. The human factor, especially opinion and insight from the top, is important in determining the direction of a policy.

This approach is different from the EU and the US, where NEV policies usually just define the objectives, i.e., "zero-emission" or "low-emission", but leave the choice of technology to the enterprises and ultimately the market, where those enterprises compete. In China, the NEVs development path is designed from the top, and a top-down formed coalition backs the decisions made from the top. In this coalition, a group of elites has the power to shape the policy, and that enables quick policy learning and adjustment. Members of the elite group usually include leaders from the Communist Party of China (CPC), the State Council and relevant departments, and SOEs, academia, scholars trained overseas, civil society, and even international experts who are consulted by the national government. In the case of NEVs, some influential persons and organizations are essential to the policy. For example, the former minister of the MOST, Wan Gang, who was trained overseas, has much experience in the auto sector and was the chief scientist of the initial 863 Program's NEV project, had been actively engaged in the promotion of NEVs and influencing the policy.[66] Others include think tanks, such as the China EV100, a group of national experts from the government, industry, and academia. Those people have the strongest voice in shaping the policies.

[65] D1ev.com. (2018-12-26). Is FCV's spring coming? Accessed on May 26, 2019 from https://www.d1ev.com/news/jishu/84847.
[66] Zhang Cuicui. Wan Gang: Cheerleader of China's NEVs development. (2013-07-14). Accessed on May 26, 2019 from http://auto.ifeng.com/fangtan/20130714/869344.shtml

6.3 Roadblocks, Constraints & Adaptation

Subsidy fraud associated with NEVs policy and implementation mechanisms has generated widespread media attention through news coverage. The subsidies were intended to first cultivate a market for the industry, then seek higher quality development. However, enterprises become less interested in lowering the cost and advancing the technology; rather, they tried to obtain as many of the government subsidies as they could while they were still available. They manipulated sales data, registered ineligible vehicles, and produced cars designed for maximizing subsidies received instead of catering to customer needs. A subsidy fraud scandal arose in 2016, resulting in a list of enterprises that cheated for NEVs subsidies being published by the MOF. Five enterprises are on the list and the total subsidies being illegally obtained were more than 1.2 billion yuan. It's reported that there were actually more than 70 enterprises that had cheated to obtain subsidies out of the 90 some enterprises being investigated, and the total amount of subsidies involved in cheating was 9.2 billion.[67]

This sabotage of the subsidies is partly due to the flawed design of the subsidy scheme and the lack of monitoring and supervision. For example, a driving range-based subsidy standard encouraged automakers to install more batteries in the vehicle, rather than put more efforts into increasing the energy density, which causes an increase in the vehicles weight and GHG emission.

The following is quoted from academician Yang Yusheng in a speech he gave in May 2016:[68]

[67] Peple.com.cn. (2016-9-28). NEV enterprises cheating: extensive subsidy and misjudge of the market. Accessed on June 23, 2019 from http://energy.people.com.cn/n1/2016/0918/c71661-28720539.html.

[68] Leiphone.com. (2016-05-15). Academician Yang Yusheng: NEVs subsidy is risking itself to be the new "Great Leap". Accessed on June 23, 2019 from https://www.leiphone.com/news/201605/oB4X9jXtX5me9vw8.html.

> “Two years before the Shanghai EXPO, a 12-meter battery bus was sold for 1.6 million yuan; one year later, it was sold for 1.9 million yuan; three months before the EXPO, it was sold for 2.6 million yuan. In such a short time the bus increased its price by 1 million yuan.
>
> High subsidies push the enterprises to produce pure battery buses, to which the government provided the highest subsidy. State-run bus groups provided guaranteed orders, so there’s no worry about the customer. Manufacturers wouldn’t try to lower the cost, on the contrary, they increased the price intentionally.
>
> Automakers are producing based on the standards of subsidy. Most of the subsidies become their high profit. Commercial vehicles get subsidies for more than its production cost. These high subsidies have created bad habits in some automakers, who just focus on short-term profits. They make vehicles that are expensive, but not what the market really demands.”

Local protectionism is another phenomenon that stemmed from the subsidy scheme. Many cities launched matching subsidies to the central government’s incentives; however, that doesn’t ensure seamless coordination among the policies. Although the national government launched a policy inhibited discrimination towards automakers that are established in other places, cities still launched preferential policies for local automakers.

For example, Beijing’s public transportation company signed a contract to buy 800 new energy buses from Beijing’s BAIC by the end of 2008, which effectively blocked other companies from entering the market. Beijing also doesn’t recognize Plug Hybrid Electric Vehicle (PHEV) to be qualified to enjoy local NEVs policy benefits, such as buyer subsidies and being in a much smaller lottery pool to get a vehicle number plate. One big reason is that the local SOE, BAIC, only produces pure battery NEVs. This policy successfully differentiates Beijing’s car sales

pattern: in 2016, 62,720 BEVs versus 715 PHEVs were sold in Beijing, while in Shanghai, 12,048 were BEVs and 33,103 were PHEVs.[69]

Due to this local protectionism, NEVs enterprises have to set up branches in different cities to obtain the subsidies. Sometimes having a registered sales company is not enough; automakers have to set up assembly factories if they want to obtain an order of new energy buses and taxies from the local government. Take BYD, for example. Its headquarters is located in Shenzhen, but it has production bases all over the country, including Beijing, Shanghai, Xi'an, Huizhou, Shaoguan, Hangzhou, Ningbo, Shangluo, Changsha, Dalian, Nanjing, Wuzhou, and Qingdao. Qingdao's NEV subsidies can only be received by automakers that registered in Qingdao. Xi'an's Government dictates that only cars produced in Xi'an are eligible for local subsidies.

Now with the reduction of subsidies, the strengthening of the subsidy standards, and the shift from direct subsidies to indirect support to supporting infrastructure, it's foreseeable that many of the NEVs companies will fail. But the cancelation of subsidies will help to correct the distortions the subsidies brought about, forcing the enterprises to focus on R&D and consumer needs, phasing out inferior automakers, and providing a more equalized market environment, i.e., level the playing field, which will help to break the territorial distortions. Many analysts are looking forward to seeing how the NEVs sector will perform after the subsidies are canceled.

6.4 Case Findings

Given the significance of NEVs in energy security, sector leadership, pollution reduction and climate change mitigation, major countries that have a NEV industry all apply industrial promotion policies such as tax exemptions, public procurement, and buyer subsidies in the NEV sector. However, there are some differences in how the policies are implemented in China.

[69] Data source: Nelson

China's NEV coalition is formed top-down, led by a strong government with clear long-term commitment to take ambitious action. The central government has been taking the lead in driving investment and innovations and guiding the development of technology. From creating the products to creating the demand, from allowing a "strategic" over supply to letting the numerous enterprises compete and consolidate, the central government led the design of the strategy, oversaw the implementation of the policy, dictated the goals of lower governments, and leveraged various public sector actors, as well as many private ones. Although the market is intended to pick the winner, as a lesson learned with the conventional fuel vehicles, a top-down approach is still the dominate approach. If not for Premier Li's visit, FCVs may not have been part of the policy. A case of letting the leadership "pick a winner" leaves a lot up to chance in terms of what decision makers are exposed to.

While the national government leads the NEVs promotion strategy, local leaders seek ways to grow the local economy and thereby increase their political capital, or are at least trying to avoid obsolescence of their local industries, driven by the cadre evaluation system which is largely based on the performance of local government in boosting development. By contrast, in the US, local (city and state) governments tend to be the leaders in the sustainable movements. Areas that promote NEVs better are those who urgently need to improve their air quality, such as California, where the market share of electric vehicles is as high as 7.84%. In China, there is no positive correlation between air quality and NEVs development by region. Actually, as one of the best cities in NEVs development, Shenzhen has very good air quality, compared to others. Cities who have the innovation capacity, favorable business environment, and an existing competitive auto industry have an advantage in developing NEVs. Cities who don't have the foregoing endowment still try to attract the industry because it is positioned as strategic by the national government.

The stakeholders in the NEV coalition are components of a growth machine. They have aligned goals of expanding the industry, so everyone benefits. The accountability mechanism, while failed

in the NEV case with the subsidy scandal and local protectionism, did aid the quick scaling up, as it is said in Chinese, “flourish all over the place”. Since China is so large, mandating public purchases of NEVs across the country, or even in the initial 25 pilot cities, can dramatically increase the size of the market, which can be a game-changer.

There are three potential problems in this top-down approach: firstly, the government-led supportive policy is inevitably skewed to SOEs, which put independent automakers at a disadvantage and may restrain innovation; secondly, the government is not in the position, nor does it have all the knowledge, to decide the needs of the market. If the plan goals and direction are proven unfitting, the advantage of fast scaling up can turn out to be disastrous, in terms of wasted resources and opportunity. Thirdly, corruption (fueled by generous subsidies) and the desire for prestige can result in misreporting and less than desirable outcomes.

The flexible system offsets some of the risks. The mix of government intervention and market measures, and the policy tools, have been adjusted, as does the technological path. This is demonstrated through the shift of focus in the Five-Year plans, and the launch of various policies at certain times. Those adjustments are made based on a small elite group’s wide consultation and thorough discussion. The decision making provides room for trial and error, and the process also enables fast action when the need of adjusting policy arises.

China’s NEVs policy has never been just an air pollution policy. For a strategic industry like NEVs, using proactive industrial policy to guide its development is the choice the Chinese government always makes. When environmental policies align with the government’s strategic goals for industrial advancement, it is much easier to create a powerful supporting coalition, with all key players strongly motivated; and as a result, the interventions tend to be much more aggressive, extensive and rapid. The alignment of goals among coalition members, the target-oriented accountability for local implementation, and the flexible responsive policy reinforce each factor to enable a resilient system.

CHAPTER 7

SHIFT OF PRODUCTION IN THE CEMENT INDUSTRY

The Shift of Production refers to the shutting down of key polluting sectors in northern China, such as cement and steel, during the winter heating period (mid-November to mid-March), to avoid overlapping pollution with the emissions from winter heating. This action was initiated by cement plants in northern China, under the circumstance of oversupply and low profitability; the action then formed a policy through the lobbying of the cement industry association, and being adopted and enforced by various levels of governments all over the nation. This innovative bottom-up policy complements the immature market in the effort to reduce excess capacity. Under the accountability system, the selective implementation of different agendas by the local governments is an adaptive response to the multiple goals they need to accomplish.

7.1 Background: The Cement Industry and the Supply Side Policy

Concrete is the second most consumed substance on earth, after water. Across the world, on average, three tonnes (3.3 tons) of concrete are consumed per person per year.[70] As a basic ingredient of concrete, cement is a highly energy and emission intensive product to manufacture. It's produced by heating limestone and other clay-like materials in a kiln at 1400°C, and then ground to form a lumpy and solid substance called clinker; clinker is then combined with gypsum and ground finer to form cement. Producing a tonne of cement requires 4.7 million BTU of energy, equivalent to about 400 pounds of coal, and generates nearly a tonne of CO_2. Energy consumption by the cement industry is almost 5% of total global industrial energy consumption, and the cement industry accounts for around 20% of all man-made CO_2 emissions (Jha, 2016).

The cement industry is a basic heavy industry that provides production inputs for other important industries such as infrastructure and real estate, thus it has a big impact on the economy. China

[70] UNEP. Greening Cement Production has a Big Role to Play in Reducing Greenhouse Gas Emissions. https://na.unep.net/geas/science/alert_2010_10.php. Accessed Sep 6, 2019.

is the biggest cement producer in the world. In 2018, China produced 2.21 billion tonnes (2.44 billion tons) of cement, representing 56% of global production.[71] Fueled by an over-a-decade-long cement-intensive infrastructure, construction, and a property boom starting in 2008, driven by the government's stimulus to cope with the plunging demand in both domestic and foreign markets after the financial crisis of 2008, the cement industry, together with other capital intensive industries such as steel, flat glass, aluminum, and coal, bloated their production capacities to unsustainable levels. Currently, China's cement capacity is over 3 billion tonnes (3.3 billion tons). The excessive capacity has caused vicious competition and economic losses by cement factories.

A supply side reform was launched by the Chinese government in 2015 to cope with this type of situation. Unlike the previously favored demand side policies, which emphasize more investment, export and domestic consumption, the supply side policies aim at improving the structural, long-term performance of the sector and the overall economy. The policy package for the overall supply side reform included both market-led policies to increase efficiency, and government driven intervention to overcome market failure. The former includes canceling subsidies and other incentives, the latter includes stricter control of expansion and tougher environmental, and other, regulations.

The key element to the cement industry's excess capacity is over capacity of clinker production. According to the China Cement Association's plan to cut capacity, from 2018 to 2020, 25% of existing clinker factories are designated to be shut down to make the average utilization of clinker capacity reach 80%, and the average utilization of cement capacity reach 70%. If implemented, this means about 400 million tonnes (441 million tons) of clinker capacity would be eliminated by 2020.

[71] Data source: China Statistics Bureau, United States Geological Survey.

Although there will still be an over-capacity problem, the closure of coal and steel plants is mainly to be achieved through administrative measures, with support from a special government fund of 100 billion yuan (US$ 14.3 billion), which the cement industry is not eligible to receive. With the goals being to reduce the cement industry's excess capacity, increase its efficiency, and upgrade product quality, the Chinese government adopted the following measures:

(i) Prohibiting adding new clinker production capacity. Measures include prohibiting land supply for clinker production, stringent environmental impact assessments to deter its production, and eliminating loan and tax breaks related to new clinker projects.

(ii) Eliminating lower quality cement products. Output capacity of lower grade "composite 32.5" cement accounts for around 50% of the country's total cement capacity. Higher grade cement uses more clinker, thus this measure can help to absorb the excess clinker on the market, while still reducing the total output of cement.

The output of clinker has been increasing, from 1.37 billion tonnes (1.51 billion tons) in 2016 to 1.42 billion tonnes (1.57 billion tons) in 2018. Cement output peaked in 2014 at 2.48 billion tonnes (2.73 billion tons), and for the first time in recent decades, decreased to 2.35 billion tonnes in 2015 (2.59 billion tons). Except for a slight increase in 2016, it continued to decrease to 2.21 billion tonnes (2.44 billion tons) in 2018. This illustrates the upgraded product structure of the cement industry.[72]

(iii) Stricter environmental, production safety, and quality inspection, which thins the profit margin of smaller cement enterprises, and benefits the leading enterprises which have more standardized production, more advanced techniques and can better comply with environmental rules. As a result of this measure, a lot of idle capacity was shut down. In addition, a policy was

[72] Data source: China Cement Association.

adopted that ordered production lines that produce below 2000t/day to shut down when pollution levels are high.

(iii) Encouraging industry consolidation. This policy aims to increase the level of industrial concentration, which means the top ten cement makers will control 70% of the total clinker production and 60% of the total cement production. To do this, the Chinese government and the China Cement Association encouraged mergers and supported production integration through cross shareholdings and joint investment. The purpose is for enterprises to integrate the production capacity and optimize allocations, to increase the whole industry's competitiveness. State-owned enterprises grow bigger through mergers and acquisitions, but private enterprises don't necessarily have less stakes than the SOEs.

(iv) Shift of production. This policy shifted the cement production schedule. The cement factories in Northern China cease production during the winter heating period, and resume production after the heating period ends in the spring.[73] This policy is further detailed in the next section.

Compared to other bloated industries, the cement industry faces more market competition, and its production is easier to control. Firstly, the physical character of cement favors fewer intermediary links from production to sale. Cement is not storable, for it slowly absorbs the humidity in the air and hardens quickly. There's usually a maximum of one month turnover time for the cement and three months for clinker. Secondly, it is heavy and has low per unit value, so transport cost accounts for a big part of its price. Thus, the cement industry is relatively evenly distributed among regions. Thirdly, the cost of turning on and off a cement kiln is much lower compared to steel manufacturing. Given the seasonal fluctuation in demand, the shorter supply chain, and the proximity of production to market, the cement industry is more sensitive, and can be adjusted, to meet market demand.

[73] China cement association (ccment.com).

7.2 Implementation Description & Assessment

7.2.1 The Shift of Production Policy

Unlike the previously discussed two policies in the chapters 5 and 6, which were designed and implemented in a top-down manner, the Shift of Production – where Northern cement factories ceased production during the winter heating period – was initially a tentative initiative organized by the cement association, with voluntary participation by cement enterprises. Later on, the government adopted the approach, making it into mandatory regulation with enforcement tools as part of the government's wider supply-side management approach to reducing excessive cement capacity, upgrade the sector's structure, and reduce air pollution.

A common practice of cement plants in China, before the shift of production policy was launched, was that they produced the clinker in the winter when the demand is low, stored it until the Spring Festival holiday was over, then ground the clinker and produced cement. By doing so they could supply the market right away when the construction resumed. However, since the timing of clinker production overlaps with that of the winter heating period in Northern China, it exacerbates air pollution. Also, in order to compete for market share, cement enterprises usually produce at full capacity in the winter, which results in excessive products when the weather warms up, causing prices to drop.

Jointly pausing production has been a common practice among the cement enterprises in northeastern China since the early 2010s, when the fierce price competition resulted in profit losses for every enterprise. The cement associations were actively involved in coordinating such actions. The participating enterprises, and those who don't participate, all benefit from the raised profitability.

The transformation from this practice into a national policy was first jointly-proposed by dozens of committee members of the National Political Consultative Conference (NPCC), the top political

advisory body of China, during the “two sessions” in early 2014. In December of that year, a symposium on Shift of Production policy in Beijing, Tianjin, and the surrounding four provinces was held, with participants from the National Ministry of Industry and Information Technology (MIIT), the local Industry and Information Technology Commission, and Cement Associations. The symposium passed the Pan Northern China Cement Enterprises Shift of Production Self-Disciplinary Joint Pledge. It specified that the shift of production plan be in effect during the time between January 15 and March 15 in 2015, in The Capital Region (i.e., the above mentioned 2 cities and 4 provinces). In this Joint Pledge, it also specified enforcement measures, including public exposure on sectoral internal media, talks with enterprise leaders, eliminating enterprises from the market access list, disapproval of production permits or annual inspections, and increasing the amount of fines for pollution discharge by non-compliant enterprises. This Joint Pledge came into effect after the cement enterprises leaders signed it voluntarily.

The policy was more widely adopted in the winter of 2015. The Ministry of Industry and Information Technology (MIIT) and the then Ministry of Environmental Protection (MEP) jointly announced a circular on the trial implementation of the policy in 15 northern provinces. In 2016, the General Office of State Council published the “guidelines for stabilizing growth, adjusting structure and increasing economic returns in the building material industry” (State Council General Office [2016] 34), in which it requires using “shift of production” as an important tool to reduce excess production capacity; it also further requested that the policy be fully implemented in the northern region during the winter heating period, and in other regions during the spring festival holiday and in the summer. Since 2017, the policy has been routinized in the cement industry and was mandated to expand to other industries such as steel, foundry, and bricks and ceramics, as per the MIIT.

However, it will be more challenging to apply this policy to the coal and steel industries. Getting companies to voluntarily cooperate to cut capacity is the key to the success of this policy. The large number of independent coal mining businesses that are scattered among regions brings the

“free rider” problem into play, and turning on and off steelmaking furnaces entails much higher costs than in the cement case. In the cement industry, given its highly regional markets, and the limited number of competitors in a given region, an agreement among companies to reduce capacity is more likely.

The Shift of Production policy limited the cement production through environmental rules. Its implementation brought three major outcomes:

The first is increased clinker capacity utilization rate, as a result of the closure of inefficient facilities combined with a slowing of new and expanded production facilities, to bring down the total production capacity. In 2015, the total production capacity of clinker was 1.81 billion tonnes (2 billion tons), with only 66.9% of the production capacity being used. By the end of 2018, the total production capacity of clinker had decreased to 1.72 billion tonnes, and the utilizing ratio of clinker production capacity had increased to 70.7% (Figure 7.1). The lower production volume under the Shift of Production policy and steady demand supported the price of cement, which helped sustain producer margins.

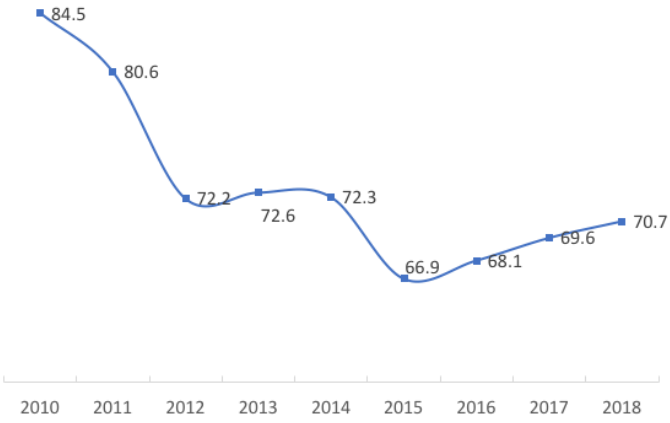

Figure 7. 1 Clinker Capacity Utilization Rate

Source: China Cement Association

The second effect is a higher concentration ratio in China's cement industry. According to China Cement Association's plan to cut capacity, China's top 10 cement producers will have 80% of the nation's total cement production by 2020. In 2010, China's top 10 cement producers only accounted for 44% of clinker capacity. In 2018, this number had increased to 64%. A series of mergers occurred since the Shift of Production policy was launched. Stricter environmental regulations, and the costs associated with the lack of production during the winter months (e.g., paying basic salary to inactive workers), made it hard for smaller cement factories to sustain, and facilitated the merger. The increased concentration in the cement industry is viewed as key to reduced capacity and sustainable profits.

The third effect of the policy brought was emission reduction. Suspended production during the winter helps to alleviate the overlapped pollution from heating and industrial emissions. In winter 2016, there were 475 cement enterprises in the 15 northern provinces participating in the shift from winter to spring clinker production schedules, which accounted for 92.4% of the total cement enterprises. This reduced winter clinker output by 237.9 billion tonnes (262 billion tons), which translates into a reduction of 205.8 million tonnes (227 million tons) of CO_2, 7.3 thousand tonnes (8,000 tons) of SO_2, 261 thousand tonnes (288 thousand tons) of NOx, and 29.6 thousand tonnes (32.6 thousand tons) of dust during the winter months, when air quality in the Northern China is at its worst. It also helped the enterprises to reduce costs by 30.6 billion yuan (4.9 billion USD) through cost reductions in storing clinker.[74]

The policy, while achieving the aforementioned goals, avoided large scale laying off of workers. In 2016, 182 thousand employees were affected by this policy. But the policy is designed to not lay off workers.[75] During the period when production is suspended, most enterprises, especially big

[74] Data source: China Cement Association. (2017-06-15). Fifteen provinces in northern China Shift of Production work summary of 2016.

[75] Economic Daily. 2017-05-16. Cement industry "shift of production" will be implemented nation-wide

cement corporations, still pay a basic salary to their workers, provide skill and safety training, and organize other activities, which keeps stability and morale stable among the workers.

A member of the Building Materials Association expressed support for these policies and their impact on the industry. According to the BMA secretary, Wang Chongguang:[76]

> "Shift of production and stricter enforcement of environmental rules are very effective in reducing the excess production capacity. It's especially beneficial to the industry as a whole, in terms of increasing the profit, stabilizing the price, and avoiding vicious competition. By comparison, some measures in the past, including the market measures, didn't work well. Those who are not benefited from this policy are those low end, high energy consuming and high polluting cement factories. I think this is how it's supposed to be. Their production lines are not compliant to environmental standards, and they should be shut down. These policies forced the enterprises to preserve energy, reduce emissions, and advance their technology, which helps the upgrading of the products.
>
> The issue [over capacity] is about the life and death of the industry. Our enterprises have been working so hard, but produced excessive products, which brings no profit and wastes social and natural resources, and [created] pollution. Thus, I totally agree with what the Ministry of Environment is doing. To me, the only thing that needs to be adjusted is the pace and strictness of the policy. It should be in a reasonable threshold to be not too aggressive, but also be effective."

[76] Source: the minutes of a MEE internal expert consulting meeting "the third quarter of 2018 environmental and economic status and trend seminar", September 20, 2018, Guoerzhao Hotel Beijing.

7.2.2 Implementation analysis

Coalition- stakeholder analysis

The Shift of Production policy institutionalized cooperation among cement enterprises, and resulted in them jointly reducing capacity. In the coalition, the main actors included the central government, local governments, big and small cement enterprises, and the cement association (Figure 7.2).

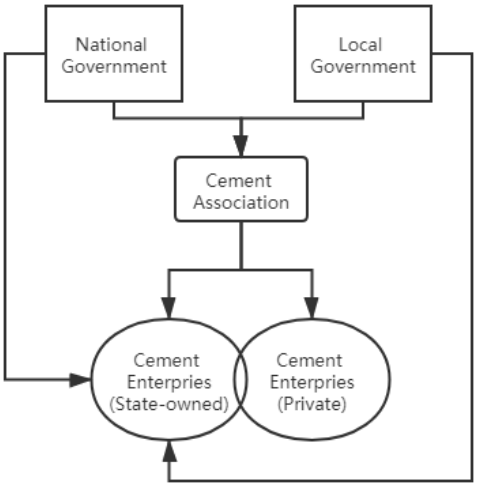

Figure 7. 2 Shift of Production Stakeholder Coalition

Source: the author.

(i) The central government wants to push forward its plan in restructuring the economy, reducing excess capacity, upgrading with higher quality products, and pushing forward the green shift of the economy, while still preserving stability (employment) and growth. To achieve these goals, a higher industrial concentration rate is desired, since it makes the policy measures easier to carry out. The central government has launched a series of documents to facilitate the merging and regrouping of enterprises in sectors with overcapacity issues for the last decade. In the “State Council’s opinion on facilitating merging and regrouping of enterprises” issued in 2010, it urges relevant government departments and local governments to facilitate enterprises in cement and rare earth industries to acquire and merge with smaller and scattered ones, and consolidate and

regroup across regions, to reduce the risk brought by unemployment and non-performing assets. Measures include tax break, allowing private enterprises to enter certain natural monopoly industries and make the competitive aspects of their operations fully market based, budgeting special funds for state owned capital operation to assist central government owned enterprises to merge and regroup, and encouraging banks to loan to such activities.

(ii) The implementation of the policy that central government wants to see, however, faces barriers at the local level. Local governments have a different position. Industries which have excess capacity are usually tied closely with local fiscal revenue, employment, and social stability, thus local governments are not motivated to reduce capacity. Expansion may even be encouraged by the local governments, which exacerbates the overcapacity situation. While the central government is promoting policies such as “phase out outdated capacity” and “replace with less capacity”, local governments often prevent factory closures to maintain employment levels. Many low-technology and heavy polluting plants which would likely close in a market-based environment have been supported by local governments and continue to operate. This situation, on one hand, intensifies the oversupply; on the other hand, it increases local debt risk, and that risk could be transferred to the central government.

(iii) The cement associations play an active role in coordinating cement plants’ actions. The national cement association is comprised of more than 3,000 member cement corporations, and there are local associations in each province. The association’s major goal is to increase the profitability of the whole industry, thus it supports the reduction of excess capacity, the merging of enterprises, and the upgrading of products, through tougher environmental rules. In fact, the Shift of Production policy was initiated by the Association, aimed at reducing the excess capacity. Within the Association, it is common that cement corporations hold shares in each other’s firms, which helps them to negotiate on price and take coordinated actions to pause production.

(iv) Cement enterprises have benefited from the coordinated shift of production action. With lower supply during the annual pausing period, the raised cement price brought them higher profits, even with reduced production. In 2018, the average price for “PO42.5” grade cement was 427 yuan/tonne (55 USD/ton), a 77 yuan (11 USD) over the previous year, while profits rose by 114% compared to 2017. The profit rate was 17.5%, 11 percentage points higher than the average of all industries.[77]

The policy especially benefits big cement plants that have more advanced technology, equipment and management. For smaller cement plants, under stricter enforcement of environmental regulations, they don’t have enough resources to increase environmental protection investment and strengthen environmental management, thus many of them either lost market share and shut down, or were acquired by larger companies.

The stakeholders have different interests in the Shift of Production coalition. Before the coordinated halting of the kilns took place, each company acted in its own interest, which led to adverse market outcomes. However, with uncertain market prospects, none of the firms is willing to exit the market first, but rather wants to take the advantage of others leaving first. The result is deadlock among competing companies. The policy created some common ground to reach agreement. The policy was initiated by cement factories in northern China, so there was already a high level of buy-in on the part of the enterprises. But the pact was difficult to sustain due to the free-rider problem. The government was critical to creating an even playing field. First, the government formalized the Shift of Production policy for all northern producers. When, soon after its implementation, the biggest cement corporation in Southern China, the Conch Corporation, started encroaching on its northern competitors’ market, spurred by the higher prices and reduced supply in the north, and using the low cost Yangtze River waterway to transport its

[77] Data source: Zhitongcaijing.com.

product, the MIIT expanded the Shift of Production policy to Southern China cement producers as well.

Accountability

Accountability is tricky in the implementation of the Shift of Production policy. Pausing production will inevitably affect some cement plants' profits, which directly affects local revenue. Local environmental officials need to find a way to accommodate multiple, and sometimes conflicting mandates. Environmental agencies from higher level governments mandate the strict implementation of the policy, while local mayors need to balance the local demands for economic development while avoiding punishment for noncompliance with environmental regulations. Under the pressure of multiple accountability, local environmental officials have to judge the situation and make a practical choice. That choice usually means being flexible and taking as little risk as possible to navigate among both environmental and economic goals.

Interviews with key informants illustrate this balancing act and the pressures on local officials:

> "We don't like the Shift of Production policy. Cement plants in Southern China have better profitability, and they are not willing to halt production. Conch Cement Corporation, the second biggest cement corporation in China, is located in our municipality. It has advanced environmental equipment and good profitability. We only ask it to pause one production line when the air quality index has heavy pollution. So we are quite flexible in terms of the implementation of that policy. However, our superior government, i.e., the provincial government, usually implements the policy in a "one size fits all" manner. We don't mandate the enterprise to stop running, and if the inspectors from the provincial government caught the enterprises producing when they 'shouldn't be', I can only say they've had bad luck."

----- interview with Guo Zhong, the EPB deputy director of Tongling, Anhui province

The interview was done through Wechat app, on Aug 11, 2019. It has been translated from Chinese.

> "Some local governments don't do their job in the daily management, and when it comes to the inspection, they mandate the enterprises to be shut down, trying to cover up the problem. Given the limited understanding of the intention of policy, the street level implementing personnel would close all of the operating enterprises without considering their levels of environmental performance, or just for the sake of fairness, to close everything. To be fair, the work load that local governments need to handle is too heavy, compared to the personnel and resources they have. With so much work at hand, it's hard to require them to implement the policy with a thoughtful mind and knowing why instead of knowing what."

----- Wu Shunze, the director of Policy Research Center for Environment and Economy, MEE
In an interview with New Beijing Daily, December 8, 2018. Source: prcee.org.

Flexibility

Because of accountability conflicts, as described in Guo's interview, the policy is implemented somewhat flexibly at the local level – even when not sanctioned by higher governments. Meanwhile, the policy itself has gone through some adjustments. While the policy has gradually become normalized and routinized, it received criticism that the "one size fits all" implementation style didn't suit different situations and regions. In 2018, the policy was amended to allow production to continue during the halting period for cement plants that are engaged in coordinated solid waste treatment and residential heating projects, and have lowered their emissions below the industry standard. This will help to encourage enterprises to improve their waste treatment, and alleviate the negative impact of pausing production on economic activities. On the other hand, this adjustment increases the difficulty of monitoring and inspecting the policy implementation, and leaves room for taking advantage of and playing the system.

Another flexible feature of the policy is that it experiments with mixed ownership mergers. Mixed ownership is one in which the SOEs and the privately owned cement enterprises are consolidated into a single corporation with a hybrid ownership structure of both state-owned and privately owned shares. As mentioned earlier, the Chinese government prefers mergers and consolidation for reducing the excess capacity, which to an extent can buffer the shutdown of factories and the induced laying off workers. Since 2014, China started to experiment with mixed ownership SOEs, and one of the two pilot enterprises is CNBM, the biggest cement corporation today. To eliminate the excess production capacity, while avoiding causing high social and financial costs from shutting down massive cement plants, mergers were viewed as a middle-way. The competitive neutrality principle,[78] and the elimination of limits on the controlling shareholder that has to be an SOE, have facilitated the mergers of several private cement plants by the CNBM. CNBM was originally an SOE, but today its state-owned share accounts for 25%, and the remaining 75% belongs to private shareholders and investors. This innovative approach helped to reduce excess production capacity while enhancing the competitiveness and marketization of SOEs.

7.3 Roadblocks, Constraints & Adaptation

Despite the positive effects the policy has brought overall, there are some controversies. The first is the market distortion effect of limiting the production through policy intervention. At the same time that the cement output was being reduced, the demand soared and pushed up the price. The price increase in turn makes the companies unwilling to close down, especially the smaller scale and outdated ones. As a result, to date, there remains significant overcapacity in the cement industry. A considerable part of the excess capacity is only in a state of suspension, not eliminated. As cement profits increase, it spurs the resumption of production, and even stimulates capacity expansion. Also, if not all the enterprises suspend their production at the same time, it becomes a prisoner's dilemma, and those who don't comply enjoy the benefits. The delay of

[78] As per the definition in the NPC & CPPCC annual sessions 2019, the competitive neutrality principle means that the government will ensure enterprises under all forms of ownership be treated on an equal footing regarding access to factors of production, market access and licenses, business operations, government procurement and public biddings.

closures has also postponed the negative effects of cement closures and bankruptcy on the financial industry. The cement industry accounts for a large share of bank loans and other forms of financial resources. Eventually, however, debt problems will emerge, forcing the closure and bankruptcy of overcapacity enterprises, which will increase non-performing loans and bad assets of banks.

The second controversy with the policy is that it has caused an imbalance in profit distribution among state-owned and private cement enterprises. In the first half of 2018, the profit the SOEs gained was 31.5% higher compared to the same time in 2017, while private cement enterprises profits grew by just 10%. SOEs are concentrated in most upstream industries, which require intensive capital investment. The higher concentration rate brings them pricing power, which cuts into downstream profits and squeezes the profit share of the private enterprises.

The third controversial issue is that the shift of production has led to higher overall energy consumption per unit. Some provinces require the suspension of 30% production capacity in the winter period, or on heavily polluted days. Although the pollutant emission is reduced, the energy used to produce the 70% is the same as operating at full capacity, increasing the unit cost of cement.

The fourth controversial issue is that while the routinized environmental protection measures reduced the total production of cement and the increased price benefited China's cement industry and the enterprises, it has also significantly increased the cost of inputs for the downstream industries, and compressed their profitability. There are some discussions on whether this policy is leading to regional monopolies. Some consider the policy as anti-competitive, especially the downstream enterprises such as property development, which have been complaining to the NDRC about the cement industry's manipulation of price. But according to China's Anti-Monopoly Law, an agreement among enterprises in the same industry is allowed under certain circumstances, such as for the purpose of mitigating serious and obvious excessive production,

and for achieving public interests such as reducing the levels of emissions. The Shift of Production agreement and policy clearly meet these conditions.

7.4 Case Findings

In the shift of production policy, the government did not rely just on administrative measures, or just on market competition. By adopting the bottom-up, innovative agreement of halting production initiated by cement enterprises, and turning it into a top-down policy to mandate cooperation and voluntary agreements for joint capacity closures, the government and the industry associations have worked closely with cement enterprises and provided support to achieve the policy goals. It reduced the pollution emissions and the supply to the market, returned the loss-making cement industry back to profitability, and paved the way for the industry's further transformation and upgrading.

The reduction of the excess capacity is the result of both the invisible hand of the market and the visible hand of the government, but the market is restricted by the government intervention. The implementation is mainly through the leading cement enterprises, mostly SOEs, to merge and acquire smaller ones. They were also expected to shoulder the tasks of eliminating the lower quality capacity, and minimizing the bad loans of the banks, and the laying off of workers. SOEs are used as a government tool – even in industries like cement, where the private market is quite active – to consolidate and control the market. Environmental policies, including halting production, and stricter enforcement and inspection, closure of outdated factories, are used as another tool to assist with this goal.

In theory, with free market, companies that operate least efficiently would be out-competed and forced to close. But in practice, this requires the enforcement of laws and regulations with respect to environmental protection, product quality, and safety. Incomplete enforcement of such regulations at this stage caused the price of many industrial products to not fully reflect the true costs of production, and is more likely to result in "bad money driving out the good".

The government has the goals of consolidating the cement sector and reducing overcapacity. While allocating more resources to SOEs have helped to consolidate the industry, it also brings the risk of distorting the market and fueling more overcapacity.

The cement association played a pivotal role in this regard. As a bridge between the governments and the enterprises, it organized the enterprises to reach an agreement to reduce production; meanwhile, such kinds of associations have close ties with the government, so this innovative approach was adopted and became policy.

In implementing the policy, the relationship between the central and local governments is both important and challenging. The game between them, to a large extent, determines the effectiveness of the policy. Although both central and local governments want growth, the central government has a longer-term vision, thus it wants to reform through structural change. For local governments, it needs to maintain a certain growth rate to compete with their peers, i.e., other local governments. They want to both wait and see, and also keep the production in their own region, so they can gain revenue from other regions' efforts in reducing excess capacity.

The progression of the policy shows the government is introducing intensified market competition. Currently, SOEs dominate the overcapacity industries. Without SOE reform, the reduction of capacity goals will not be achieved. The government has shown signals of reducing government intervention and strengthen the role of the market in resource allocation. Competitive neutrality principle has been added to the Anti-Monopoly Law. Policies include lowering the market entry thresholds to encourage private capital to enter certain industries; allowing private capital to merge and reorganize inefficient SOEs, and exploring mixed ownership in SOE reform; and subsidy reform. It can be predicted that with the routinization of the Shift of Production policy, and the consolidation of the cement industry, cement enterprises are seeking more advanced technology and greener production. A potential implementation gap of the progressed Shift of

Production policy is that it is starting to be applied more liberally and case-specifically, which could undermine the leveling of the playing field, and lead to opportunistic behavior.

CHAPTER 8

CONCLUSION AND POLICY IMPLICATIONS

8.1 A Brief Summary

Using these three case studies, this research discusses how flexibility and accountability of the Chinese governance system affects stakeholder behavior. These two factors are used to explain the major stakeholders' behavior, which affects the policy implementation performance. Table 8.1 summarized the major stakeholders' behavior under the two characters in each case.

Table 8. 1 How Flexibility and Accountability Affect Stakeholder Behavior in the Three Cases

Policy	Flexibility	Accountability
Coal to Gas/Electricity Conversion	When the over conversion caused natural gas shortage, stakeholders adapted accordingly - The national government adjusted the policy to allow households to burn coal - The SOEs mobilized resources to ensure the natural gas supply for northern China - Personal relationship came into play to solve local shortage issues	- The national government is accountable for the national goals defined in the APPCAP - The local government is accountable to carry out the action to complete the conversion of 3 million households in 2 months. The inspection mechanism facilitated the implementation.
New Energy Vehicle Policy	- The national government has been adjusting the mix of government intervention and market mechanism at different phases of the NEV industry's development; Policy learning from previous lessons. - The local government follows the national government; the state-owned and private enterprises actively participating in the campaign, and adjust their strategies under the government's guidance.	- The national goal of total sales of NEV is defined in relevant plans. - The "ten cities one thousand cars" program set the targets for local governments of the pilot cities to have NEV sales reach 1000 cars (non-binding)
Shift of Production	- National government has adjusted the policy to allow cement factories to continue production if it is coordinated with solid waste treatment and residential heating projects, and if they have lowered their emissions below the industry standard. - The policy experiments with mixed ownership mergers and practices the competition neutrality principle.	- The national government set up the strategy of supply side reform, and set goals to reduce outdated and excessive capacity in key industries. - The cement association set up the goal to reduce excessive capacity in the cement industry. - Local government oversees the shift of production in its jurisdiction. - Leadership in cement factories, especially in SOEs, is accountable for the shift of production in its factory.

Flexibility and accountability played out differently in each of the three cases, which have been reflected in the implementation process and the policy adjustment along the process. In the Coal to Gas/Electricity conversion policy, the accountability is strict with high potential for sanctions, while time for implementing the policy is very limited and budget constraint. The key for the achievement of the policy is a strong coalition, in which local governments were mobilized under the pressure of inspection, and the SOEs carried out the infrastructure installation and flexibly tackled the gas shortage problem. In later stage of the implementation, more flexibility was given to localities to make suitable action plans, and the adjustment of the policy also showcased the flexibility at the top.

The NEV policy is an industrial policy which promotes the NEV industry through pilot and demonstration projects. This is a common policy approach in China. Under the central government's mega objectives, the local governments are drafters of local plans and reports on the NEV development and its progress. However, if they do not draft the plan or report their work, the national government does not have sufficient legal, financial, or organizational means to force them to do so. Due to the policy's experimental nature, the goals are not binding, thus the local implementors have less accountability. The multiple instances of policy change in adjusting the mix of the administration measures and market reflect the flexibility at the top.

The Shift of Production is a regulatory policy. The difference of this policy from the conventional regulatory policy, such as environmental standards, is that this policy was initiated from bottom up. The government endorsed this approach, and established the accountability mechanism to ensure enforcement. The adoption of the bottom-up policy innovation reflected the flexibility at the top. Although stakeholders in the coalition are not accordant with each other, such as the contradictions between the national and local governments, or between bigger cement factories and smaller ones, the policy is successful in terms the outcome.

The three policies demonstrate that the Chinese government has a very strong implementation capability. This implementation capacity also applies to China's green transformation - the current priority of the CPC. Green goals are translated into action by the whole society from the top, and each tier of the government is involved: development banks provide financial support for industrial goals and environmental goals, SOEs obtain the resources to carry out identified tasks, and public awareness is raised simultaneously. The strong capability of mobilization and flexible adjustment imbedded in the Chinese governance system ensured rapid implementation. The accomplishment of a massive coal to gas/electricity conversion in a very short time period, the rapid growth of the NEV industry, and the pause of cement production demonstrated that the authoritarian government could "concentrate the resources to accomplish big tasks", especially in implementing the policy of a prioritized government agenda.

8.2 Conclusions

8.2.1 How accountability affects stakeholder behavior

In all three policies, the central government acts as the "anchor", with its accountability laying on setting the agenda and the frame which fit into China's development trajectory. Due to the convergence of economic upgrading/restructuring goals and environmental goals, current environmental policies cover a wide range, and carry multiple purposes. The increasing concern with the environment, along with continuous commitment to economic growth, helps to form alliances among stakeholders and mobilize resources from different government departments and social entities.

Under this context, the government uses environmental policy as a tool to fulfill its responsibility, i.e., boosting new growth and improving the people's wellbeing. Environmental policy is used as a "Green Machine" to tackle the shortfalls in the economic "Growth Machine". Improving environmental quality is as much political as technical, and is a national priority at present. The concept of "eco-civilization" was added to the constitution of the CPC after the 18th People's Congress in 2012, under the context of the slowing economy, oversupply of many heavy

industrial products, and the pressure for a cleaner environment from both domestic and international communities. Upgrading industries and restructuring energy consumption are at the core of the national government's supply side reform strategies, and environmental protection is becoming less of an economic tradeoff.[79]

The coal to gas conversion has a goal of upgrading the energy structure, the NEV policy has less to do with the environmental goals than with the "boosting the emerging industry" goal, and the Shift of Production was merely a price cartel at the beginning which was transformed to a government mandate with multiple goals. Under the "blue sky" campaign, the implementation of all these environmental related policies are able to mobilize resources, in the forms of subsidies, economic instruments, or being endorsed by the government and enforced by administrative tools, such as strict inspection, and were implemented in a speedy manner.

For the Chinese bureaucratic system, the upwards accountability is a defining character for various tiers of local governments. The CPC has thoroughly penetrated China's administrative and social systems – from local governments at all levels to private sector actors, from SOEs to neighborhoods. Under the central government's guidance, local governments are mobilized to carry out the policy measures: either by being mandated to install new infrastructure, as with the Coal to Gas case, by ceasing production as with the Shift of Production case, or by being incentivized to develop the NEV industry. State-owned and private enterprises join the coalition to be part of the game, either to avoid penalty or to obtain benefits.

Another tool to enforce the accountability is the government to shape public opinion and ignore opposition. This character is more obvious in the Coal to Gas conversion and the Shift of Production policy, where the central government makes the policy and the local government

[79] Wu Shunze. (2019-01-09). How to understand the four arguments on the relationship between environment and the economy? On China Environmental Newspaper. Accessed on February 4, 2020 from https://www.cenews.com.cn/opinion/201901/t20190109_891505.html.

implements the mandate. The households accept the conversion from coal to natural gas or electricity, based on the government's arrangement; and cement factories cease production, or get fined for not doing so. Even in the NEV policy where the government primarily used carrots to get the public onboard, the fact that the local government could exclude other non-local NEVs that the citizens may have preferred suggests the public doesn't have big sway.

As effective as it is, this upwards accountability model has innate flaws that cause distortion during implementation. The absence of bottom-up participation in the agenda setting provides limited feedback mechanisms from local implementors, and indifference to variables among different sub-national regions in socio-economic and physical-geographical characteristics. There is also a lack of adequate participation by the general public. The current hierarchical structure, with the concentration of power in the hands of CPC chiefs, and the authoritarian culture, is inhospitable to thorough discussion within the governance networks that incorporate multiple stakeholders from both the state and society (including the private sector) to devise and deliver solutions to complex issues. The reality is, even within the small elite group where policy formulation discussions take place before the policy is launched, the powerful party may only allow selective participation, such that only those policy specialists who are submissive to the leadership's will are invited to be involved in the discussions underlying policy design.

The lack of bottom-up participation in policy making and implementation can weaken or even distort the intended policy outcome. For example, the short supply of natural gas, and the subsidy scandal in the NEV case, raised red flags concerning the campaign style policy implementation deployed. In the current system, local administrators are not responsible for giving feedback on the policies. Given the system's high capability in upscaling and replication, and how big the Chinese market is, if the policy design is poor, this situation can be especially destructive.

8.2.2 How flexibility affects stakeholder behavior

In the three cases, the central government is flexible in adjusting the policies during the implementation process, and adopting the innovative policies being invented at the ground level. Local governments' (and other local stakeholders) flexibility is reflected in their adaptive behavior in implementing those policies.

The central government implements the flexibility principle through a variety of policy tools, which have a wide range of intervention regarding the trade-off of market and government. There is a built-in self-correction mechanism in China's governance system. The authoritarian government has been constantly making institutional reforms and adjusting the mix between the government and the market. The mechanism that strategic decisions are made based on thorough discussions within a small leadership group makes it efficient to make policy adjustments. Unlike the Western democratic system, China's one-party system means that the fate of the CPC is closely tied to the success or failure of this act, and so can adjust the system as needed. The CPC needs to ensure this system properly responds to the public's voice to justify its legitimacy.

This governance model related to environmental improvement, under the umbrella of the "blue sky" campaign, is not simply operating through top-down command and control mechanisms. There is a mix of government intervention and market instruments in play, plus social feedback and third sector associations involvement.

The level of the mix, and the mix of instruments deployed (government, market, and other) is different in each case. The Coal to Gas and the NEV policy making is mostly top-down. Coal to gas conversion is a simple Research & Development derived policy, i.e., a policy based on an underlying technical principle which is based on known technology, and the government is attempting to implement it on a large scale in a timely manner. The dominant implementation instrument is regulatory, supplemented by oversight and the prospect of punishment for

noncompliance. For this policy, the central government delegates power to local authorities to administer the conversion, and there is very little room left for the market.

The NEV policy has a more comprehensive, multi-objective agenda, and while the central government initiates the promotion of NEVs, intervenes in the market and subsidizes (at different rates, including zero, over time) new energy vehicles over traditional cars, it also leaves room for the market to run its course and select the winners from competition. The dominant implementation instrument is economic tools and investment. In the Shift of Production policy, the government played a role of endorsing and institutionalizing the bottom-up, market-driven cartel. The third sector played an essential role in connecting the enterprises initiative with the government policy making. In addition, the government intervention further strengthened the advantages of SOEs and helped them to merge smaller enterprises.

While the government tries to work out the right mix, the wrong mix of government intervention and market could cause distortion of the market. Although being claimed in the CPC's constitution amendment that the market should play a decisive role in resources allocation, in both the NEV policy and the Shift of Production policy, it was the government who played the decisive role. The government determines when and how much market elements are being introduced, and the industries, usually through SOEs, are over reliant on the government's guidance. The cement industry has overcapacity problems. The NEV industry is facing overcapacity, too, thanks to the subsidy from both national and local governments.

While the government has been issuing documents to eliminate outdated production capacity and encourage certain industries to consolidate, the actual effect is that those industries have been growing their production capacity instead of their competitiveness based on product quality and technological level. A common feature of the major over capacity industries regulated by the government is that they have the scale of economy, but low level of industrial concentration – a large number but small and scattered enterprises.

At the local level, the flexibility is demonstrated as adaptive implementation. While the leadership drafts the policies and oversees the implementation, local governments are key to implementation. In passing down the policy, objectives were passed down from the upper level to the lower level government through a target-accountability system, complemented by inspection and cadre evaluation. Based on the upward accountability system, the policies with binding goals are always carried out through tiered bureaucracy. Distortion in implementation is common, as seen in both the Coal to Gas and NEV policies. Given how the accountability system evaluates cadres, local cadres tend to implement the policies with flexible adjustment and cater to the evaluation standards, or just practice tokenism - “aid the good and the strong”, usually the SOEs. It then has some accomplishment to demonstrate to the upper level government and obtain recognition.

While adaptation at the local level is common in generating suitable solutions for local situations, the local government’s capacity is important in achieving policy goals. Limited local government capacity is likely to cause distortion in implementation. Such distortion occurred in the implementation of all three cases. In the regulatory Coal to Gas conversion policy, while designed goals were over accomplished, a natural gas shortage left households in the cold; the NEV policy caused waste of financial resources and cultivated a large but weak NEV industry; the Shift of Production closed compliant and noncompliant factories alike, and the later adjusting to differentiated treatment might leave room for corruption. Although all three policies were implemented, the stiff implementation at the local level could jeopardize the government’s credibility, waste public resources, and fail to achieve the broader environmental and economic goals.

8.2.3 How other major actors' behavior is being affected

Given the strong government, most policies have a strong government-oriented stakeholder coalition, in which both the state-owned and private enterprises are eager to join.

SOEs play controversial roles in policy implementation, due to their intertwined interests and personnel with the government. On one hand, SOEs are trustworthy implementors, acting under the government and the CPC's command. They carry out policies with the expectation of accomplishing the goals regardless of the cost, especially for those with political meaning. They also bear the mission of maintaining social and economic stability. On the other hand, because of favorable resource allocation towards SOEs, they form a monopoly and distort the market.

Although the government has been emphasizing the market function in resource allocation,[80] and promoting a competition neutrality principle with mixed ownership reform in SOEs, the process has been slow. In all three case studies analyzed, SOEs are heavily involved. In the Coal to Gas policy, petroleum companies are the major implementors, with many private companies being involved in gas equipment manufacturing and gas pipe installation services. In the Shift of Production policy, mergers and reorganizations take place, mainly through SOEs.

Private enterprises, as part of the policy coalition, are guided by the government through economic means such as subsidies, credits, taxation, and government procurement to support the direction of the policies; and by being regulated through administrative and legal means. Companies that fail to meet energy conservation and emission reduction standards were shut down or ordered to rectify the problem.

[80] At the Third Plenary Session of its 18th National Congress held in November 2013, the CPC stated that the market should play a decisive role in resource allocation, and that the government should play a more effective role. This idea is a continuation and extension of the concept of letting the market play a "fundamental role", which had been used for the previous 20 years. In 2019, the CPC also added this idea when it amended its constitution at the 19th CPC National Congress.

8.3 Policy Implications and Suggestions

Given the vast difference among regions, it is almost impossible to design tailored policies for each specific situation from the top. The “one size fits all” policy which was adopted in the past, mostly due to lack of resources, including personnel and expertise in policy and plan formulation and the financial resources to support it, was acknowledged to be insufficient to tackle local problems. However, a simple “differentiated policy” guideline, often seen in the central government’s policy documents, is not the solution. What is needed is improvement of implementor capacity at the local level. While accountability is an advantage to get the policy implemented, the pressurized system causes distortion. While flexibility at the local level is, in principle, an advantage, sloppy or selective implementation can be the consequence.

Although all three of the air pollution related policies analyzed were implemented with variable success, the success or failure of the policy does not merely depend on whether local implementors have carried out the central government’s mandates. The combination of policy design and implementation can create both positive and negative outcomes. When a well-designed policy is combined with good execution, the outcome is positive; similarly, if a poorly designed policy is poorly implemented, this may also have a positive outcome because the policy was not able to be carried out. However, if a well-designed/poor implementation combination takes place, the outcome will usually be negative. Given the high capacity of the Chinese system of implementation, the quality of a policy’s design and the tools it uses is critical.

This calls for the integration of implementation into policy design. China’s policy implementation governance system is embedded in the nation’s hierarchical institutional structure and the top-down steering mechanism. The central government tends to act as if local governments will voluntarily implement the policy. Thus, consideration of implementation implications is rarely an integral part of the policy design process. However, local governments may have different goals, and their implementation involvement cannot be assumed. The same applies to enterprises. SOEs, although affiliated with the government, need to find a balance between the “political

tasks" assigned by the government, and the profitability, which is usually fueled by government investment, causing unequal market setting, in which also stand the trying-to-strive private enterprises.

Based on the analysis of the three air pollution policies, I suggest the following for policy implementation in China.

i) Policy makers should make the design of the implementation apparatus to be an integral part of policy formulation. Implementation mechanisms should be carefully designed for different policies, and more balance between authority and responsibility is needed between national and local governments, i.e., the powers of local governments should be enhanced in policy implementation.

ii) There should be more open discussion in policy networks involving a wider range of stakeholders before the policy is launched. In the formation of policy design coalition, other actors in the policy process, other than governments and SOEs, such as residents, consumers, and private firms, are rarely addressed. Given that at present, the technical capacity for information disclosure and dissemination is high and inexpensive, and the internet and smart phones have made the cost of public participation greatly reduced, public participation is feasible without the existence of opposing political parties and costly elections. The authoritarian one-party state can progress from learning from wide participation.

iii) On the government side, the channels to communicate the policy effects and impacts should be opened up. The government should break the linear top-down policy process, and introduce more feedback mechanisms for the local cadres and other key stakeholders to better inform policy design based on policy implementation at the ground level. Local governments shouldn't be passive recipients of guidance from the central government, but they need to actively

participate in the policy design process, and influence the decision makers formulating policy at the top of the system.

iv) Pilot projects should be carried out on complex policy issues for a relatively prolonged time period before massive adoption of a policy, to enable proper policy implementation assessment. The pilot project approach has proven to work well in China; trial and error allows time to explore the efficacy and the negative impacts of policies.

(v) Local capacity building should be set as a priority. The policy makers at the top already realize that the “one size fits all” approach doesn’t work. But the guidance on flexibility is not good enough to have each locality implement policies in a way that best suits their situations. One important quality for successful policy implementation is to have people involved that are more prone to "knowing how" than to "knowing what". Knowing facts and ways to implement policy is not nearly as important to policy success as knowing how to make things happen and to do things right (Pressman & Wildavsky,1984).

8.4 Future research

In this research, efforts have been made to establish a theoretical framework for analyzing policy implementation under the Chinese context, based on the study of three representative air pollution policies. The contribution of this research lies on the elaboration of how the two important features in a political-administrative system, i.e., flexibility and accountability, play out differently in China in policy implementation.

In the future, more in-depth case analysis could be conducted, to both complement and test the theoretical framework this study developed, especially in the following aspects:

i) While this study answered the question of how implementation is affected by China’s governance context, more research is needed to answer how to integrate the policy

implementation guidance into the policy making process, and to design balanced accountability and flexibility levels customized for each program to achieve the intended policy outcome.

ii) Capacity building at the local level, as proposed in this study, is a key factor to improving implementation performance. But this study didn't sufficiently discuss how local capacity building can be done in conjunction with the careful balancing of accountability and flexibility. That accountability can be used to counterbalance flexibility which might lead to looseness and lack of implementation discipline, and flexibility can be used to optimize implementation performance. Future study can look at this issue further.

iii) As an important stakeholder relationship in the coalition, between national and local governments there needs to be more balance between their authority and responsibility. Further study on this issue will complement this research on coalition formation.

iv) How the leadership should implement more effective strategic interaction between the state and the market needs further study. The Chinese government has demonstrated that government intervention to set non-market prices was a practical strategy to compensate for its relative backward industries, and to boost catch-up development, but it usually causes market distortion and resource waste. Future study could monitor and evaluate the ongoing policies, and analyze the state and market combination in them.

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APPENDIX A

KEY NATIONAL LEVEL POLICY DOCUMENTS RELEVANT TO "COAL TO GAS/ELECTRICITY" CONVERSION SINCE 2013

Coordinating agency	Issuing date	Document Number	Document Name	Major Content on Coal to Gas Policy
SC	2013	State Council of PRC [2013] 37	Air Pollution Prevention and Control Action Plan (2013-2017)	Accelerate the project construction
MEP	2016 June 17	MEP [2016]80	Beijing-Tianjin-Hebei air pollution prevention and control strengthened measure (2016-2017)	BTH and four cities in Hebei
MEP	2017 Feb 17	n/a	Beijing-Tianjin-Hebei air pollution prevention and control working plan for 2017	“2+26” air pollution transfer corridor cities
MEP	2017 August 21	MEP Air [2017]110	Beijing-Tianjin-Hebei and Surrounding Regions Strengthened Air Pollution Prevention and Control Action Plan in 2017-2018 Fall and Winter	Detailed tasks of boiler phasing out and upgrading, households “coal to gas/electricity” conversion in each of the “2+26” cities; Pricing and storage policy to lower operation cost and ensure natural gas supply
MoF	2017 May 16	MoF [2017] 238	Announcement on Financial Fund Supporting Pilot Cities in Northern China Using Clean Energy for Winter Heating	Financial support to pilot cities for three years; Priority of 2+26 cities; Mainly targeting urban and suburban area, to upgrade to clean energy
NDRC	2017 December 5	NDRC and Energy [2017] 2100	Northern China Winter Clean Heating Plan (2017-2021)	A more comprehensive arrangement for cleaner energy winter heating

APPENDIX B

KEY NATIONAL LEVEL POLICY DOCUMENTS RELEVANT TO NEW ENERGY VEHICLES SINCE 2009

Issuing agency	Document Number	Document Name	Summary
MoF, MoST, NDRC, MIIT	MoF [2009]6	Announcement on starting the pilot projects of energy saving and NEV demonstration and dissemination	“Ten cities, one thousand cars” program was initiated
SC	State Council [2010] 32	The Decision to Speed up the Cultivation and Development of Strategic Emerging Industries	New Energy Vehicle as one strategic emerging industry
MoST	n/a	12th five-year Plan on Science and Technology Development	Promote BEVs and key technology of NEVs.
10 Ministries including MoC, NDRC, MoST, MIIT, MoF, MEP, etc	MoC [2011] 310	Guidelines on promoting the internationalization of strategic emerging industries	New energy vehicle is one of the seven industries promoted to be internationalized
MoF, MoST, MIIT, NDRC	MoF General Office [2011]149	Announcement on further promoting the pilot projects of energy saving vehicles and NEV demonstration and dissemination	It focuses on creating markets for NEVs and quality improvement
SC	State Council [2012] 22	Energy Saving and New Energy Vehicles Industry Development Plan (2012-2020)	Comprehensive plan specifying the objectives and measures of commercialization, including lowering operational cost, improving vehicle and battery technology, building charging station, battery recycling, and financial, fiscal and taxation incentives.
MoF, MoST, NDRC, MIIT	MoF [2013] 551	Announcement on Continuing the Promotion of NEV Dissemination and Adoption	It specified the requirements on quantity for the second-round pilot cities or regions, and purchasing subsidy standards for 2013, 2014 and 2015.
SC General Office	State Council General Office [2014] 35	Guiding Opinions of the State Council General Office on Accelerating the Promotion and Application of NEVs	Comprehensive plan on NEVs infrastructure, technology, operation, cultivation of market, etc.
SC General Office	State Council General Office [2015] 73	Guiding Opinions of the State Council General Office on Accelerating NEVs Charging Infrastructure Development	Objectives and implementation mechanism of NEVs charging infrastructure construction
MoF, MoST, MIIT, NDRC	MoF [2015] 134	Announcement on financial subsidy policy for NEV dissemination and adoption during 2016-2020	It specified the subsidy standards for 2016, and except for FCV, other NEVs will receive 20% subsidy in 2017-2018, and 40% less in 2019-2020, comparing to the subsidy in 2016.
MoF, MoST, MIIT, NDRC	MoF [2016]958	Announcement on adjusting the financial subsidy policy to promote the use of NEVs	It adjusted the subsidy standards and adopted higher technology threshold, and it mandated the total subsidy from the local governments should not exceed 50% of the subsidy from the central government.
MIIT, NDRC and MoST	MIIT [2017] 57	Auto Industry medium-to-long-term Development Plan	Set targets for promoting NEVs to leverage a greener auto industry. By 2025, the percentage of NEVs sales of total auto sales shall be above 20%. The corporate

			average fuel consumption (CAFC) of new passenger cars shall be 5.0 L/100 km in 2020 and 4.0 L/100 km in 2025.
MIIT, MoF, MoC, GAC, and AQSIQ	MIIT order 2017 no.44	Measures on Parallel Administration of Passenger Car Enterprise Average Fuel Consumption and New Energy Vehicle Credits	
MoF, MoST, NDRC, MIIT	MoF [2018] 18	Announcement by the four ministries on adjusting and improving the financial subsidy policy for NEV dissemination and adoption	It specified stricter subsidy standards, and called for strengthened inspection.

APPENDIX C

INTEVIEW QUESTIONS

Coal to Gas/Electricity Conversion

Chinese Academy of Environmental Planning (CAEP)

1. How is the policy made (or, what's the logic behind it)?
2. Who are involved in the policy making and implementation, and what role do they play in the policy process?
3. What are the problems in the policy implementation? What caused these problems?
4. What are the cause of shortage of natural gas supply?
5. How did the central government's supervision and the then MEP's inspection work in the coal to gas/electricity conversion policy implementation?

Beijing Agricultural Commission (BAC)

Hi! I'm Feifei Zhang, a PhD candidate in Urban Planning in Arizona State University. I'm doing my dissertation on China's environmental policy implementation characteristics and mechanisms. Coal to clean energy is one policy I chose as my case study. I know Beijing Agricultural Commission is the coordination agency for Beijing's "coal to gas/electricity" policy, thus I want to ask some questions regarding the implementation of this policy in Beijing. Your name won't be mentioned in my dissertation (if you agree, I will acknowledge you). Following are my questions:

1. What is the role of BAC in Beijing's "coal to gas/electricity" conversion policy?
2. Beijing started its "coal to electricity" conversion in the urban core area as early as in 2003, and it soon expanded to rural areas. What is the function of the *Air Pollution Prevent and Control Action Plan" (APPCAP)* launched in 2013, and the *Beijing Clean Air Action Plan* in the implementation of this project?
3. According to the public data, most of the conversion is from coal to electricity in Beijing. How was the type of "clean energy" chosen? Who got to decide?
4. Who are the stakeholders in Beijing's "coal to gas/electricity" policy implementation process? How does BAC coordinate them?
5. Was there "gas shortage" during the 2017-2018 winter heating period in Beijing? How does BAC coordinate SOEs such as State Grid, PetroChina and Beijing Gas Group? Are there private sectors involved? What are their roles? What is the role of households who converted their energy source from coal to natural gas or electricity?
6. How does the subsidy works? What are the changes of heating cost after subsidy? Is there long-term plans for after the subsidy is over?

PetroChina Beijing company

1. What is the role of PetroChina Beijing company in the "coal to gas/electricity" conversion policy implementation?
2. When there was gas shortage in the Beijing-Tianjin-Hebei region, were you influenced? How did you deal with this issue?
3. Can you tell me the story of "gas swap" between PetroChina and China National Offshore Oil Corporation (CNOOC)? How did it happen and why could it happen?

Qingshui Town government, Mentougou District, Beijing

1. Did households in Qingshui Town converted from coal to natural gas or electricity? Who decided which energy to use?
2. Which departments in the town government are involved? Who is the coordinator? How did the government cooperate with SOEs such as the State Grid, and private companies who supplies the equipment for heating?
3. Are there problems in terms of coordination in the policy implementation process?
4. How were the households subsidized? Are there plans in terms of subsidy in the next few years?

5. What are the changes of heating cost to households after the conversion?

Huarun Natural Gas Group

Thank you for being willing to be interviewed.

I'm doing research on coal to gas/electricity conversion policy, and my study area is Beijing-Tianjin-Hebei region. The implementation of this policy has played an important role in improving air quality.

1. What role does Huarun Gas Group play in the coal to gas conversion policy implementation in Handan city?
2. What issues exist in the policy process? From your company's perspective, how to improve to achieve win-win situation for all the stakeholders?
3. What stakeholders you need to get contact with or coordinate? Are there problems in the negotiation process? What are the causes? How did you solve the problems?
4. From your perspective, in which aspects can the national, provincial and municipal governments improve in terms of policy and implementation measures, to better the effects of the "coal to gas" policy?
5. What are your measures to ensure long-term natural gas supply?
6. Are there other natural gas suppliers in Handan? Can you help me to contact them, so I can interview them while I'm in Handan.

Thank you!

New Energy Vehicle (NEV) Policy

New Energy Vehicle Industry Association

Hi! Thank you for willing to help me with the interview. I'm Feifei Zhang, a PhD candidate in Urban Planning in Arizona State University. I'm doing my dissertation on China's environmental policy implementation characteristics and mechanisms. New Energy Vehicle is one of the policies I chose as my case study.

Since 2001 when China started the key project "Electric Vehicle" under the "863" Program umbrella, the NEV policy has experienced state-oriented strategic planning and government-led R&D, to automobile makers as the main force for industrial standards, entry regulations and the establishment of supply chain, to consumer- targeting policies, such as demonstration and pilot cities, fiscal subsidies and tax exemption. There are different focuses at different stages, and the key stakeholder are shifting along with the transition of the policy focus. In this process, China's NEV industry has witnessed rapid growth, and now the sales rank number one in the world. The recession of subsidies starting from 2017, and the launch of the "double credits" policy in 2018, represent the re-adjustment of the NEV policy, showing that the market is entering into an era that's reshuffling and there's reversed transmission of the pressure for upgrading the technology.

Interview questions:

1. In the development of China's new energy vehicle industry, what's the function of your association?
2. Please describe the relationship and interaction between your association and the governments (including national, municipal and district/ county governments), automobile manufacturers, and consumers.
3. In the implementation of NEV policy, what do you think are the best practice?
4. In the implementation of NEV policy, what are the problems or obstacles?

Ministry of Industry and Information Technology

1. What are the considerations when the national government launch the NEV policies?
2. There are currently more than a hundred NEV manufacturers in China. What are the impact of NEV policy to automobile manufacturers? What do you see the future of China's NEV industry?
3. There are different NEV promotion policies in different cities, for example, Beijing only subsidize the BEV, but many southern cities subsidize both BEV and PHEV. What are the reasons? What are the characteristics of different cities' NEV policies?
4. In terms of NEV policy, which are the most effective ones?
5. What are the obstacles and problems in the NEV policy implementation?
6. Comparing to the rapid growth of NEV, there aren't enough charging stations and the distribution is not optimal. I noticed there are new plans to improve this situation. This work will need a lot of coordination among government departments, NEV manufactures, SOEs and private sectors, what do you see the challenges and opportunities in the NEV infrastructure development?

Automobile manufacturer

1. What types of automobile vehicles do you produce?
A. traditional gas car
B. Battery only Electric Vehicle (BEV)
C. Plug-in hybrid electric vehicle (PHEV)
D. Fuel Cell Electric Vehicles (FCEV)

2. What are the impacts of new energy vehicle policies to your enterprise?

(if answer to question 1 is A):
3. Do you have plan to develop NEV models? If yes, what's the biggest difficulty or challenge?
4. In which aspects do you think NEV policy can improve?

(If answer to question 1 has B or C or D)

5. Please introduce the history of NEV R&D and manufacturing in your enterprise.
6. Which type of the following has the biggest impact to your enterprise? What are the impacts?
A. Automobile acquisition tax exemption
B. Subsidy to customers
C. Industrial standards and entry regulations
D. Others (please specify)

7. From your perspective, which aspects of the NEV policy should improve from the national and municipal government level, to better develop the NEV industry?

Automobile Sales managers

1. What types of automobile vehicles does your company sell?
A. traditional gas car
B. Battery only Electric Vehicle (BEV)
C. Plug-in hybrid electric vehicle (PHEV)
D. Fuel Cell Electric Vehicles (FCEV)

(if answer to question 1 is A):
2. Does the auto maker who produces the cars you are selling also produce NEV?
3. When consumer buying cars, do they consider NEV? Do you think NEV policy can compensate some of the disadvantages comparing to traditional gas cars?

(If answer to question 1 has B or C or D)
4. What brands of NEW does your company sell?
5. Can you talk about how well is the market performance of NEV? (If you are also selling traditional gas cars, can you also evaluate the sale situation from comparing with gas cars?)
6. How does the purchase tax exemption and subsidy policy work? Do the consumers pay the tax and get a refund? Is the subsidy paid to the manufacturer, the sales company, or the consumers?
7. Which are the following factors most important to consumers when you sell NEV to them?
A. Cost, amount of subsidy
B. Battery life (as cruising ability)
C. Battery life (whole life cycle)
D. Brand
E. Depreciation
F. Environmental protection
G. Daily maintenance
H. Others (please specify)

Professor in NEV R&D

1. What is the current technological level of NEV in China? What's the biggest technological bottleneck?
2. From your interaction with NEV manufacturers, what's their biggest concern about the NEV policy? What do you see the future of China's NEV manufacturers in the next 5 to 10 years?

Shift of Production in Cement Industry Policy

China Construction Material Association

1. What's the impact of Shift of Production policy to the cement industry? Can you describe the situation of the industry before and after the policy was launched?
2. What role does the association play in the design and implementation of the policy?
3. After the policy was tried and got positive effect in Xinjiang and northeast China, it became a national policy and rapidly disseminated to 15 northern provinces, then all over the nation. What factors do you think are important to have this policy being implemented?
4. Cement price has seen a substantial increase since this policy is adopted, but the price level now is similar comparing to 10 years ago. What does this mean to the industry, and to the pollution emission reduction efforts?
5. How are different cement enterprises influenced differently under this policy?

Cement Factory in Hebei Province – a branch of the State-Owned China United Cement Corporation

1. What are the impact of Shift of Production policy to your company?
2. What are the problems in implementing the Shift of Production policy?
3. What suggestions do you have for the policy to improve?