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China's Environmental Protection Policies and Path Dependent Analysis: In the Case of Beijing Air Pollution Control

大陸環境政策與路徑分析理論：以北京空氣汙染治理為例

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China's Environmental Protection Policies and Path Dependent Analysis: In the Case of Beijing Air Pollution Control

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中文摘要

大陸環境政策與路徑分析理論：以北京空氣污染治理為例

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摘要：
近年來，大陸已經從一個強調經濟發展的國家蛻變為一個注重經濟發展但是也關注永續發展的國家。大陸從只願付出共同但有區別責任到積極做出空氣污染管制的大國，是否可以藉由不同於以往的模型來解釋？本論文主要運用路徑分析法的概念來闡述北京的空氣污染治理政策演進，藉由設定奧運和 APEC 北京為治理的「關鍵節點」，進一步闡述國家與地方環境政策的變化與演進。而中國政策決策制度的演進也是影響環境政策的輔助因素，因此第四章也特別說明中國大陸制定決策的模式演變。希望藉由不同的理論來解釋當前北京乃至中國的環境治理，並檢視當前環境治理的不足及說明未來可能的發展方向。

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Chapter One: Introduction

Abstract

In the past decade, countries and organizations around the globe have devoted themselves to brought out the important message of sustainable development. Climate change and environmental protection have been two of the core issues to be considered into state's foreign policy. China has been facing the environmental issues in recent years. In this thesis, it argues that China's awareness of sustainable development and environmental protection, especially on air pollution problem in Beijing, was gradually flourished as time went by. From ignoring environmental problem and devoting effort on one-sided economic development to positively face and try to solve the air pollution problem, China has gone through its decision-making and mindsets reform. Furthermore, this thesis suggests that the progress of it corresponds with a certainly path. Hence, path dependent analysis would be applied to test whether this kind of path fits air pollution control methods in China and possibly foresee the environmental future of Beijing to be a cleaner and healthier city.

Introduction

In recent years, China has noticed the severity of environmental problem in its region. Beijing, its capital, was under terrible air condition for several decades because of multiple greenhouse gases (GHG) emissions. But in the past, China was unwilling to recognize the problem until the health of its people began to be threatened by the consequences of what they have emitted. Moreover, being categorized as a developing country, it was unnecessary for China to shoulder the heavy burden of CO_2 emission mitigation under Kyoto Protocol. Connie Hedegaard, the EU climate chief, made a veiled reference to China after the conference when she said:

"Some people have no contributions [on cutting] emissions under the Kyoto Protocol and they want that to last. But there is a new world order now. The rich have to do more than the poorest but all will have to do something."[1]

At 2012, China's CO_2 emission surpassed the US as the largest emitter in the world. As the statistics indicated, a record 36 billion tons of CO_2 were emitted in 2013 by the world and China itself, produced 29% of the total emission followed by the US

[1] Fiona Harvey, "China and US Hold the Key to a New Global Climate Deal," *The Guardian*, December 12, 2012.

15%.[2] With the title of the largest emitter, the world is watching and analyzing every move and policy China made. Accompanying the enormous amount used on energy, serious aftermath left China no choice but to face the problem.

China has faced and fought with severe environmental problems. Extreme weather, soil liquefaction, ecological damage by hydroelectric facilities, and air pollution are some of the disasters in China. Among all of the issues, air pollution could be the deadliest one and affect a larger number of citizens in China. By World Bank statistics, and the Chinese Academy for Environmental Planning of air pollution indicators on health concluded that between 250,000 and 500,000 people die prematurely each year as a result of outdoor air pollution in China.[3] Among all the polluted areas, Beijing owns the most severe air pollution problem. Most days in a year, the sky of the area was covered by thick cloud and its air polluted by the heavy smog produced by power plant emission and automobile exhaust. Hence, the term "blue sky days" were created to indicate the precious time for people in Beijing to witness the blue sky and, of course, the effective policies government had done.

[2] Matt McGrath, "China's Per Capita Carbon Emissions Overtake EU's," *BBC News*, September 21, 2014.
[3] Zhu Chen, Jin-Nan Wang, Guo-Xia Ma, Yan-Shen Zhang. "China Tackles the Health Effects of Air Pollution," *Chinese Academy for Environmental Planning, Beijing, China.*

Even the problem has not yet solved, we could observe the mindset and policies were turning from originally careless of environmental issues to actively remedy the problem. China's leadership began to emphasize on the challenge since 2000, both as a result of domestic pressures and international ones.[4] China's leaders have become increasingly cognizant of the need to improve the country's environment. Changing of the mindset of Chinese leaders and citizens were also worth analyzing to acquire the full picture of China's policies toward sustainable development and environmental protection. In this paper, path dependent analysis would be applied to test China's environmental policy trajectory, especially concerning air pollution problem in Beijing. For one reason it is the capital of China, which is the city when elites from all walks of life lives in and also stands for the very first impression for other country. Second, Beijing's air pollution problem is the most severe among all the polluted area including part of Hebe, Yangzi River Delta and etc. Hence, it is reasonable for China to set the priority to clean Beijing's air.

Several "critical junctures" were set for analyzing the history of China's

[4] These international pressures include those brought about by China's participation in international environmental regimes, the desire of many multinationals to ensure that they and their people are operating and living in a safe environment, and China's own desire to present a positive image when it hosts major international events such as APEC and the Olympics.

environmental policies. First is "the hosting of 2008 Summer Olympics," and the second one is the "2014 APEC Summit in Beijing." These junctures were chosen because of their similarities including location and the foreign (international) attention of both events. Chapter 3 will interpret and discuss more on this aspect.

Research Motivation

As the US stepped down on climate change issue after newly-selected president Donald Trump indicated that climate change would not be the priority of the United States and he would put emphasis on energy sector and try to maximize possible employment rate. China's role on fighting climate change suddenly become much more essential than before. China's participation in international climate change negotiations has evolved from playing a peripheral role to moving gradually to center stage.[5] Although articles have concluded that China is now stepping forward and realizing the never-before-seen endeavor for climate change.[6] But still, air pollution problem has troubling China till now. Among all the cities, Beijing serves as China's

[5] Isabel Hilton, Li Shuo, Zhang Zhongxiang, Joanna Lewis, Deborah Seligsohn, and Alex Wang, "Is China a Leader of Laggard on Climate Change?" *China File*, December 9, 2016. Last accessed: http://www.chinafile.com/conversation/china-leader-or-laggard-climate-change

[6] Hong Yuan 2013, Hilton and Kerr 2016, Li and Wang 2012.

capital, would be reasonably why China had prioritized for easing the air pollution in China as the top agenda of its environmental problem. We could observe the change of China's attitude toward the issues, but path dependent analysis has not yet been used to test the correlation of some important moments of China and the policy changes after it. The main goal of this thesis is to test whether the selected two critical junctures including "2008 Olympics" and "2014 APEC" could serve as China's turning point, or, at least the beginning of subtle change of its attitude and policies. And if this pattern could be solidified, Beijing's environmental protection would leap forward and same method could be possibly implemented on other cities in China to benefit more people and free them from air pollution problem.

The following chapters would be written as follow: chapter two would be the literature review including China's changing awareness on environmental policies, air pollution problem in Beijing, the impact of 2008 Olympics and 2014 APEC Summit, the changing decision-making model of China, and path dependent analysis; chapter three illustrates the use of path dependent analysis first from economic then to social studies; chapter four would be the in depth discussion about path China's changing decision-making model; chapter five would interpret the first critical juncture which is

2008 Olympics; chapter six would delve into the second critical juncture of 2014 APEC Summit; chapter seven would be the theoretical approach of path dependent analysis; the last chapter would include assessment of the changing attitude and closing conclusions.

Chapter Two: Literature Review

My review of related literature would consist of several parts: China's changing stands on environmental protection actions, air pollution problem in Beijing, China's decision-making model, and path dependent analysis. All of which are parts of the answers to my research question: Can China's environmental policies trajectory fits in path dependent analysis using Beijing's air pollution control as an example?

China's Changing Stands on Environmental Protection Actions

Environmental issues are not the main consideration for China before 1970.[7] The core impetus of China's national policies lied on economic development rather than cleaner energy resources or easing air or soil pollution problem. One reason was that China still categorized as "developing countries" rather than "developed countries." The ultimate goal of developing countries was to become wealthier and then could invest and develop innovative technologies to improve the original secondary problems such as environmental ones.

Thirty-five years ago, a landmark plenum of Chinese Communist Party's (CCP) famously initiated the structural reforms that boosted the country's economy into

[7] Lu Feng, and Wenjie Liao, "Legislation, Plans, and Policies for Prevention and Control of Air Pollution in China: Achievements, Challenges, and Improvements," *Journal of Cleaner Production* 112 (2016): 1549-1558.

export-oriented overdrive, transformed China into a world power, and spawned a daunting array of environmental challenges.[8] Now as the economic growth has slowed down, China is now confronting the consequences of its three-decade focus on economic development and expansion with little attention paid to mounting ecological and social costs. Also, two things are for sure now: first, China's leadership is now feeling intensifying public pressure to do something about the environment. A growing number of people are fed up with government's inaction on environmental issues; second, unlike 1978, when all that mattered was the economy, today "economic, ecological, and social reforms" jostle for attention.[9] As the paper will discuss later, the decision-making process has also been altering along the path. Public pressure gained its influence in China's decision making process. The closed-door model has been proved as incongruity after the spread of message to the public mainly through the internet. China couldn't hold the strong man's decision making model for all of its polices.

On the other hand, we could observe the transcendent changes in China's

[8] "China at Crossroads: Balancing the Economy and Environment," *Yale Environment* 360. http://e360.yale.edu/features/china_at_crossroads_balancing_the_economy_and_environment (last availble: 2017 April 2)
[9] Ibid.

principle national policy, the Five Year Plan (FYP). Chinese government implemented several new policies during the 10th and 11th FYP to improve environmental pollution control efforts and reduce energy consumption. According to a survey, the investment for environment was doubled than that in the 9th during the 10th FYP.[10] From the weight of money spend can we began to argue the changing awareness of its environmental problems. Later in chapter 7, two pairs of FYP (one pair is 10th and 11th, the other is 12th and 13th) would be compared to testify the turning of China's stands on environmental protection and sustainable development.

More recently, China's intended nationally determined contribution (INDC) was proposed on June 30th, 2016 before the Paris Agreement to show the determination of Chinese government on fighting global climate change and its domestic environmental problems. The main goal was to cut down on CO_2 emission by 40-45% in year 2020 on the basis of 2005. Besides the cut-down, China also intended to raise the ratio of non-fossil energy usage by 15% including wind, solar, thermal, and other types of renewable resources. Different measures were suggested and put into words

[10] Litao Wang, Carey Jang, Yang Zhang, Kai Wang, Qiang Chang, David Streets, Joshua Fu, Yu Lei, Jeremy Schreifels, Kebin He, Jiming Hao, Yun-Fat Lam, Jerry Lin, Nicholas Meskhidze, Scott Voorhees, Dale Evarts and, Sharon Phillips, "Assessment of air quality benefits from national air pollution control policies in China. Part I: Background, emission scenarios and evaluation of meteorological predictions," *Atmospheric Environment* 44 (2010): 3442-3448.

in different national policies such as "China's Policies and Actions for Addressing Climate Change" (first issued in 2007, then 2011 through 2015), 12th FYP and 13th FYP and etc. Both domestic and international news were reported the actions for fighting climate change in 12th FYP were considered to be successful.[11] Air pollution of course is a huge issue, but there are other pollution problems also in China such as polluted drinking water and soil pollution. But this thesis would only focus on the air pollution in Beijing to see whether China could improve or even solve the problem with its changing attitude.

Air Pollution Problem in Beijing

Air pollution has caused different regions in China to suffer from it, these regions include Beijing, Yangtze River Delta, Hebe province and etc. It has already been widely discussed to ease the air pollution problem in China.

In different mega cities, different major air pollutants are affecting citizens' pulmonary system. Particular matter (PM)[12], SO_2, and NO_2 are considered to be the most prominent air pollutants in Beijing.[13] PM were found 34% from mineral sources

[11] "Beijing Air Quality Improved in 2014 Despite Pollution Alerts, Authorities Say," *The Guardian*, January 5, 2016. Last accessed: https://www.theguardian.com/environment/2016/jan/05/beijing-air-quality-improved-in-2015-despite-pollution-alerts-authorities-say

[12] Definition for $PM_{2.5}$: fine particles less than 2.5 micrometers in diameter
Definition for PM_{10}: coarse particles 2.5 to 19 micrometers in diameter

[13] "True Reveal of Beijing's PM2.5 Sources: Local pollution take up to 70%," *Sina Tech*, October 31, 2014. Last accessed: http://tech.sina.com.cn/d/2014-10-31/14329750274.shtml

from cement, steel manufacture, smelting and fugitive dust at the industrial site, 20% contribution from a coal-fired power plant and a 16% contribution from the anthropogenic regional background.[14] The other major pollutants were mainly contributed by the vehicle and its growing population. Hence, the vehicle control measures taken during the 2008 Olympics and 2014 APEC Summit had successfully decreased the air pollution during both periods of time.[15] Still, there are other non-Beijing sources (NBS) of pollutants including dust storm and air pollutant from nearby regions. The complexity of sources and the heavy dependency on coal burning industry made the air pollution problem in Beijing hard to ameliorate.

So, can we say the air in Beijing is cleaner now? Do people in Beijing still need to wear mask to go out for school? Both answers would be yes under the short term measures, but in the long term, government has to do much more to ensure the "yes" answer for both questions. Luckily, we could observe the commendable change of air quality in recent years in Beijing. The rising awareness of the problem came after Beijing was chosen to be the hosting of 2008 Summer Olympics, though it was not

[14] Chak K. Chan, XiaoHong Yao, "Air Pollution in Mega Cities in Chins," *Atmospheric Environment* 42 (2008): 1-42.
[15] Wen Xu, "Beijinghuanbaoju: Jidongchexianxingdui 'APEC Blue' gongxianzuida" (Beijing Environmental Protection Bureau: Limitations on Motor Vehicles had Great Contribution to the "APEC Blue"), *Tengxun*, December 18, 2014. Last accessed: http://news.qq.com/a/20141218/003202.htm?pgv_ref=aio2012&ptlang=205

the primary concern for China to clean the air.[16] But cleaning the air pollution in Beijing is still a must-do, otherwise athletes around the world would not attend the Beijing Olympics. Haile Gebrselassie, two times Olympics gold medal owner from Ethiopia claimed that he won't be able to run for his country because the air in Beijing would trigger his asthma[17]. Such claims would cause to China lose the prestige which it wished to get from the Olympics because China couldn't even manage to better the air pollution problem "in their capital." For fighting air pollution, China issued a large amount of different measures to counter air pollution problem before 2008 Olympics. Since December 1998, its municipal government had implemented 10 stages of comprehensive emergency control measures and a series of new local emission standards were promulgated and implemented to mitigate the SO_2, NO_x and PM pollution from coal burning, industry, vehicle exhaust and fugitive dust. Estimated that Beijing's power plants emitted 49% of the total SO_2 emission, either to search for an alternative power sources like wind or solar or to "move" the power plants away from Beijing, measures against power plant greenhouse gas emissions were fully implemented to ease the air pollution problem in Beijing. One can argue that Beijing's

[16] Virendra Verma, "Beijing Olympics: An Exhibition of Chinese Soft Power."
[17] Michael Phillips, "Gebrselassie out of Beijing Marathon," *The Guardian*, March 11, 2008. Last accessed: https://www.theguardian.com/sport/2008/mar/11/athletics.sport

air has improved, but also scholars and researchers found out that China's temporary fixes to create clean air during high-profile and politically sensitive events are making smog worse in the long run. They indicated that pollution levels bounced back dramatically and levels were even worse than expected after the meetings has finished.[18] Even though the air pollution problem in Beijing has not yet been solved, government has showed the willingness and citizens as well as majority people in China now share the predilection to improve the air pollution problem. This is a good sign of starting to solve the environmental issues in China, at least it is better than neglecting the problems and saying that developed countries need to do more than developing countries.

China's Decision-making Process and Its Influence

The decision making process in China has great influence on the output of its policies. Several phases of the process could be observed and categorized. This paper then suggested that the changing of decision making model in its environmental policies had also contributed some key change of the concept in environmental protection along the history. According to Shaoguang Wang, a professor and analysist

[18] Serenitie Wang, and Katie Hunt, "China: 'Political Blue Sky Comes at a Price," *CNN*, December 16, 2016.
http://edition.cnn.com/2016/12/15/asia/china-air-pollution-study/

in Tsinghua University, saying that

> "the Chinese government has gone through several phases of decision-making process which were: the closed-door model and the mobilization model which became obsolete in these years; the inside access model which could be normal practiced in recent years; the reach-out model and the outside access model which were occasionally observed now; and the last one, the popular-pressure model that are frequently seen in recent events and policies."[19]

The rising awareness of environmental changes could be categorized in the last one, the popular-pressure model, especially when the "real $PM_{2.5}$" statistics were disclosed in Beijing. People's awareness somehow cause pressure for government to react and change the policy path because of the popular-pressure. Statistics showed that about three-quarters of people in China say air pollution is a big problem, including 35 percent who regard it as a "very severe problem."[20] Also, a broad majority (71 percent) of Chinese support an international deal limiting GHG emissions, roughly in line with the 78 percent of global average.[21] This could not be

[19] Shaoguang Wang, "Changing Models of China's Policy Agenda Setting," *Modern China* 34, (2008 Jan):

[20] George Gao, "As Smog Hangs Over Beijing, Chinese Cite Air Pollution as Major Concerns," *PewResearch Center*, December 10, 2015. http://www.pewresearch.org/fact-tank/2015/12/10/as-smog-hangs-over-beijing-chinese-cite-air-pollution-as-major-concern/

[21] Ibid.

true when we look back in the 60s when the closed-door model was obviously the mainstream or the only stream for decision making. Hence, understanding the flow of China's decision making process could also provide another dimension of information on policy changes and evidence of changing idea about environmental protection and sustainable development.

Path Dependent Analysis and Its Core Value

Path dependent analysis can be used as a way to track the changing of certain ideas or policies; thus this paper argues that the environmental protection awareness of China could fit the model for explaining the changing path of China's environmental policies. In order to begin utilizing the model, it is required to set and illustrate the two core points in the analysis. They are "critical juncture" and "self-reinforcing factors." Some scholars such as Paul Pierson (2004)[22], Giovanni Capoccia (2007)[23] and Collier and Collier (1991) laid their research pivot on critical junctures as some other scholars for example, Paul A. Romer (1986), Weir (1992) and Krasner (1988) emphasized the importance of self-reinforcing factors to be more decisive in path dependent analysis.

[22] Paul Pierson, "Politics in Time," *Princeton University Press*, 2004.
[23] Giovanni Capoccia, and R. Daniel Kelemen, "They Study of Critical Junctures: Theory, Narrative, and Counterfactuals in Historical Institutionalism," *World Politics* 59 (April 2007), 341-369.

Critical junctures are the moment when relatively small events occurred in a random time of history and eventually cause the path of observed policies to change after some time.[24] For this thesis, two major critical junctures were set to illustrate. The first one is "2008 Beijing Summer Olympics," and the second one is "2014 APEC Summit in Beijing." Historical institutionalist scholars often emphasize critical moments in politics, distinctive developmental sequences, and the rigidities that make it difficult for social actors to escape from established paths.[25] Both selected moments are considered to greatly contribute to the changing of China's perspective toward sustainable development and environmental protection issues.

Self-reinforcing factors are the feedbacks from its previous changing policies that could cause nation to stay on the altered path when they face the similar situation in the future. These feedbacks could be categorized into "functional effect" and "distributional effect of institutions." Functional effect indicates that actors adapt their strategies in ways that reflect but also reinforce the logic of the system[26]; distributional effect of institutions reinforce the statements on institutions, saying that

[24] Paul Pierson, "Increasing Returns, Path Dependence, and the Study of Politics," *The American Political Science Review* 94, no. 2 (June 2000): 263-266.
[25] Ibid.
[26] Some good examples are Streeck's (1992) work on the political economy of Germany, Schneider's (1997) analysis of the developmental state in Latin America and Vogel's (1996) analysis of the politics of deregulation in the political economies of the advanced industrial countries.

they are not neutral coordinating mechanisms but in fact reflect, also reproduce and magnify particular patterns of power distribution in politics.[27]

We could list some pros and cons of both "critical juncture" and "self-reinforcing effect" for comparisons. For critical junctures, the advantage is for scholars to look specifically at the different patterns of interaction between ongoing political processes and at the effect of these interactions on institutional and other outcomes. On the other hand, it is hard to specify the mechanisms that translate critical juncture into lasting political legacies. For self-reinforcing effect, it could provide many insights into the mechanism that account for continuity over time but the strong tools for understanding continuity are not matched by equally sophisticated tools for understanding political and institutional change.[28] For analyzing events through the eyes of path dependent analysis, the events need not to have both critical junctures and self-reinforcing effect to build up the whole scenario. Of course the more it could fit, the stronger it would be the explanation. Since scholars have emphasizing on either critical juncture or self-reinforcing effect, this paper will focus on critical

[27] Well-interpreted in Esping-Anderson's (1990) work on decommodifying effects of universal welfare states and Karl's (1997) study of petroleum-states.
[28] Kathleen Thelen, "Historical Institutionalism in Comparative Politics," *Annual Review Political Science* 1992: 369-404.

junctures for interpretation of the analysis.

Chapter Conclusion

From above reviews, China's stands on air pollution problem, in the case of Beijing, has gone through some critical moments for change. China has paid much more attention on this deadly problem from either policy points of view or decision-making points of view. For this paper, the main purpose is trying to apply the path dependent analysis into China's changing stance of air pollution and sustainable development problem. For the following chapters, the choosing of critical junctures and how the policies were changed would be shown to explain the path dependent analysis into Beijing's air pollution problem.

Chapter Three: Path Dependent Analysis

Chapter three presents the originality of path dependent analysis and more detailed information about its core value mentioned in chapter two, "critical juncture" and "self-reinforcing effect." Closing with the reasoning of choosing both 2008 Olympics and 2014 APEC Summit as critical junctures for Beijing's air pollution management.

The Origin

The very first usage of path dependent analysis was applied in economic field of research. W. Brian Arthur and Paul A. David set the principally concepts of the path dependence analysis. With their concept for a path dependent development to occur is that a technology is subject to self-reinforcement, respectively positive feedback.[29] Increasing returns could provide the utility for actors to choose the same path later on when facing similar situations.

To broaden the usage of path dependence analysis, Douglas North applied the concept in his institutional change theory. Thus, the idea of institution was introduced into the analysis. To understand institution, we first reviewed the definition brought out by North, "Institutions are the rules of the game in a society. Or more formally,

[29] W. Brian Arthur, "Competing Technologies, Increasing Returns, and Lock-In by Historical Events," *The Economic Journal* 394 (1989): 116-131.

are the humanly devised constraints that shape human interaction."[30] He also argued that the path dependence analysis could fully applied to institutional analysis because there are increasing returns to institutions.[31]

Paul Pierson extended the use of path dependency analysis into political science. He even mentioned that applying the analysis to political analysis could be much more relevant than economic analysis.[32] He argues that the condition of increasing returns is always present in the case of political institutions because they create common expectations among actors and thus lower the transaction costs associated with coordinating behavior.[33] Paul Pierson also extended the original limitation on "endogeneity requirement."[34] He indicated that not every path is characterized by self-reinforcing sequences, but may depend on factors that are external to the process itself.

Kathleen's work further summarized the previous work and focused in particular

[30] Douglas C. North, "Institutions, Institutional Change and Economic Performance," *Cambridge University Press*, 1990.
[31] Ibid.
[32] Paul Pierson, "The Path to European Integration: A Historical Institutionalist Approach," *Comparative Politics Studies* 29 (1996): 123-163.
[33] Thomas Rixen, and Lora Viola, "Uses and Abuses of the Concept of Path Dependence: Notes toward a Clearer Theory of Institutional Change," July 2009.
[34] First, when Arthur and David explained the analysis, they took endogeneity to be a second essential characteristic of path dependence. Both condition of "reproduction" and "endogeneity" needed to be met to characterize a process as path dependent. See more on Thomas et al.'s "Uses and Abuses of the Concept of Path Dependence: Notes toward a Clearer Theory of Institutional Change," 2009: 6-8.

on founding moments and "critical junctures." Her papers criticized former concept of path dependence as "both too contingent and too deterministic."[35] From her point of view, it is too contingent because in the initial choice situation small events can make an overly big difference. It is too deterministic because once a path is adopted there is automatic stability. She suggested the gradual change may occur, and that stability will have to be actively produced by political actors.[36]

Core Concept: Critical Juncture

According to Collier and Collier 's paper, a critical juncture could be defined as "a period of significant change, which typically occurs in distinct ways in different countries (or other units of analysis) and which is hypothesized to produce distinct legacies."[37] Another definition by Capoccia and Kelemen, "relatively short periods of time during which there is a substantially heightened probability that agent's choices will affect the outcome of interest." By "substantially heightened probability," they referred to the probability that agents' choice will affect the outcome of interest must be high relative to that probability before and after the juncture.[38]

[35] Thelen 1999, 385
[36] Ibid.
[37] Ibid., 23.
[38] Ibid., 23.

Both of the definitions contain several similarities. First, critical juncture is the time when distinct policies are made during the historical timeline; second, the change would last for at least a period of time and constrain future choices.

Critical junctures also have to meet some requirements. First, junctures have to be relatively "small events" since major events are more prone to cause changes. But why 2008 Beijing Olympics and 2014 APEC Summit could be considered small events? Detailed explanations will be offered in the later part; Second, major changes needed to be observed in order for one to argue it is a critical juncture. Either from the difference principle policies of FYP or the proportion of funds provided for environmental policies, the focus of China has gradually changing its pivot toward a more environmental friendly aspect. Thus, critical juncture believers suggested that with the appearance of these time periods along the history, actors would change its original path according to either the limitation of the events or its domestic needs for the events. As the result, the change will persist afterwards when the actor is facing identical or similar choosing conditions.

Core Concept: Self-Reinforcing Effect

The concept of self-reinforcing effect was brought out by mathematicians. They

called the process a “Polya urn process.” Imagine a very large urn containing two balls, one is black, the other is red. Remove one ball, and then return it to the urn, accompanied by an additional ball of the same color. Repeat this process until the urn fills up. The additional ball here simply means the effect of increasing return. So the second time, or the 100th time you repeat the process, there are very high possibility that the urn is going to be full of either red or black balls. The process perfectly shows the essence of path dependence analysis. When one actor act (to pick a ball) in an event (to play the Polya urn process), the increasing return (to put another ball which is the same color one picks) will make the actor hard to go back to its original path (at first, the color ratio was 50% 50%, since one color ball was added, the ratio is gradually changing). Each step along a particular path produces consequences which make that path more attractive for the next round. When such effects begin to accumulate, they generate a powerful virtuous cycle of self-reinforcing activity. Paul Pierson consider four prominent aspects which social politics conducive to increasing return process: the central role of collective action; the high density of institutions; the possibilities for using political authority to enhance asymmetries of power; and its

intrinsic complexity and opacity.[39] The argument allow the path dependence analysis to fit more into research fields in social sciences.

In social science, it is because of the self-reinforcing effect that actors or decision makers will not "go back" to its original path of policies. The effect either comes from domestic region or foreign countries, such as positive feedbacks from the public or foreign organizations. These feedbacks then form the potential power for the actor to act in the same way as last time whenever it meets similar activities in the future. Hence, the changing policies could be witnessed and the path dependent analysis could be founded.

The Choosing of Both Events

The basic elements to recognize an event as critical juncture relies on the visibility of policy turns and it has to be relatively small event. Since historians all considered big events will surely be the change of certainly policy, path dependent analysis emphasizes on the effect on the small event. So how could 2008 Olympics, a mega-sport events in a great scale, be categorized into critical juncture? The core reason is the word "small" could have different interpretations. For this paper, "small"

[39] Paul Pierson, "Increasing Returns, Path Dependence, and the Study of Politics," *The American Political Science Review* 94, no.2 (Jun2000): 251-267.

neither necessary have to be the size of the event nor the amount of money poured into the event, but the "concept of the event." We could conclude that the main concept for 2008 Olympics was not to offer Beijing municipal area a clean atmosphere but to hold a mega-sport event for the world to see that China, as well as other developed countries in the world, could manage to handle the massive work for holding the Olympic Games and hence, to show the national power of China[40]. Air pollution problem was the byproduct because of the event. So, these kinds of international, huge-in-scale event could literally force China to alter its path of its original disinterest for environmental issue such as Beijing's air pollution problem.

As well as the 2014 APEC Summit, its original purpose was to gather the leaders around pacific region to discuss about the economic future and possible further cooperation economically and politically. However, "APEC Blue" came as another media spotlight simply because again, the air was clean when an international mega events was held in Beijing.

Chapter Conclusion

In this thesis, 2008 Beijing Olympics and 2014 APEC Summit were set to be the

[40] Evans Phidelis Aryabaha, "The Role of the Beijing Olympics in China's Public Diplomacy and its Impact on Politics, Economics and Environment," *University of Malta*, (2010): 81.

critical juncture of Beijing's air pollution problem. The two activities shared some common grounds: first, both of them were held in Beijing. This is the basic and the most important common ground because if the events were not held in Beijing, Beijing's government won' t have the intention and pressure to implement such stringent policies effort; second, international actors were involved to watch China's move. In Yu's perspective, China's policy-making, at least in the area of climate change, is actually highly coordinated and is subjected more to international rather than domestic constraints.[41] Hence, international events such as the 2008 Olympics and 2014 APEC Summit were chosen to be the critical junctures in this thesis; third, by statistics, the air quality during both activities and short term after the activities were obviously better than their preparation time. Path dependent analysis especially using critical junctures for explanation, can offer a different perspective on Beijing's air pollution control issue.

[41] Yu Hong Yuan, "Global Warming and China's Environmental Diplomacy," *Nova Science Publisher* (2008): 9-10.

Chapter Four: China's Changing Decision Making Model

When discussing national policies, the domestic factor of decision-making process should also be considered as well. A more closed-door model of decision-making would lead to a more leader- or small group-oriented decision; on the other hand, if the decision-making process would lean to outside assess or public-pressure model, the policies would then reflect more of public voices. No matter which process is being used in China now for environmental policies, it is patently affecting the trajectory of environmental and sustainable development for China in recent years. Five decision making models were categorized. In this chapter, all the models would be introduced and further focused on the two models that would commensurately fit air pollution and environmental protection policies.

Introduction of The Five Decision Making Models in China

Scholars have categorized and listed out the five different models through China's decision-making history. Separately, they are "the closed-door model", "the mobilization model", "the inside access model", "the outside access model", and "the

popular-pressure model."[42] In this chapter, only "the closed-door model" and "the popular-pressure models would be introduced in detail because these two represent the two extreme of policy decision making process which China both applied. The popular pressure model has grown as a huge social power and the opinion of the public has somehow been influential to the core of China in recent years.

The Closed-door Model

The closed-door model could be traced back to Mao Zedong's time. the main purpose and idea was to exclude the participation of the public and made the decision on the ruler's own will. Either from the top leader or from the small leading group, it would be unnecessary for general public to engage in the decision making process. In this model, the public was assumed of lacking the ability to understand the complexities of the policy issue, and therefore, at no point is the public greatly involved. The other reason for the unnecessity of public involvement would be the decision-making time will last too long and by that time, maybe the circumstances will not meet the leader's interest.

[42] Shaoguang Wang, "Changing Models of China's Policy Agenda Setting," *The Chinese University of Hong Kong and Tsinghua University*.

For the closed-door model, it could mostly be found in authoritarian states like China (in the past), Cuba, and North Korea.[43] But still, in modern China, closed-door model has not yet fully disappeared. For example, in 1988, the CCP Politburo realized that prices had risen so fast that people could no longer endure it, the state council then took some measures[44] to hold down prices to stabilize the domestic purchasing market. But for most of the time, this decision-making model would be discovered at economic policies, which the market changed so swiftly and for China some measures taken by central governing team would be much effective than letting all provinces to make decisions on their own. However, the previous example let the consumer price index rocketed all the way to 18.8 percent in 1988 and discontent was soon contagious, which partly foreshadowed the political crisis in 1989.[45] Closed-door model is a two-sided blade interpreting that general public would feel the wisdom of the decision maker if he or she made the right decision, but on the other hand, once a decision maker made the wrong decision, strong aftermath could lead to political crisis or even worse situations.

[43] Sukhoon Hong, "What Does North Korea Want from China? Understanding Pyongyang's Policy Priorities toward Beijing," *The Korean Journal of International Studies* 12 (2014): 281.
[44] Those measures included exerting control over government expenditures and cutting down investment in fixed assets. Then the state council decided to increase the purchase prices of some agricultural products and to replace the old practice of price-fixing with open subsidies to urban employees.
[45] Ibid., 41.

The Mobilization Model

A similar model as closed-door would be "the mobilization model." The main difference between the two model is that the latter policy makers have to go out, reach the general public to acquire the support of the mass public for its implementation but at the same time, the announcement of the new program is in fact the final result of governmental decision making.[46] This kind of model was implemented when policy makers lack the resources necessary for executing the agenda or when the public has developed a strong sense of participation.[47] Mostly it was applied in setting almost all major and strategic agendas in Mao's era from Land Reform, the Three-Anti and Five-Anti campaigns, the Great Leap Forward to the Cultural Revolution. After the opening of China, some issues remained to be raised under this decision-making progress[48]. For example, the one child policy in 1980, speeding up the reform of the urban economy in 1984, pushing forward the wage reform in state-owned enterprises in 1985, restructuring the labor system through breaking the iron rice bowl in 1986,

[46] Roger Cobb, Jennie-Keith Ross, and Marc Howard Ross, "Agenda building as a Comparative Political Process," *The American Political Science Review* 70 (1976): 135.
[47] Other possible timing includes: when the legitimacy of the closed-door model is widely questioned, if successful implementation of such as agenda requires widespread, enthusiastic support from the mass public
[48] "Zhongguo gongchandang dashiji, 1978–2003" (Chronicle of the Chinese Communist Party, 1978–2003), *Renmin wang* (People's Web). Last accessed: http://cpc.people.com.cn/GB/64162/64164/index.html

and advancing the reform of the old-age pension system of public enterprises in 1995. but more and more issues are now being disclosed to the public and thus other forms of decision-making process have begun to take over.

The Inside Access Model

In this model, there is only interaction between policy makers and advisors, but little, if any, interaction between the mass public and policy makers. This model was applied more frequently after the reform. Though public was not the decisive element of decision-making, the leaders had changed the mindsets and let a little more number of people, which is the official brain trust that is close to the core of the power.[49] The name implies the decision making process came from "inside" which refers to the leader or the small groups rather than the "outside" which is the mass public. One good example is the communique on the establishment of diplomatic relations between China and West Germany on September 29, 1972. During the cold war time, WangShu, a staff reporter with the Xinhua News Agency in West Germany, wrote an in-depth analysis of the Soviet strategic posture suggested that China should abandon the old view that West Germany was a "militaristic, revanchist country." His voice

[49] Andreas Hofem, and Sebastian Heilmann, "Bringing the Low-Carbon Agenda to China: A Study in Transnational Policy Diffusion," *Journal of Current Chinese Affairs* 42 (2013): 201.

was the crucial point for China to speedily develop relations with West Germany. The main reason for China to accept the model was that "China had profoundly altered its strategic priorities." It changes from making a country to stand on its own feet to the prosper of it.[50]

The Outside Access Model

As we move on, public voices were trying to catch more attention to the government. This model refers to a situation in which a citizen or a group of them submits suggestions on public affairs in the form of a letter to central decision makers, excluding complaints or appeals about the interests of an individual or a small group.[51] However, for these "policy advisors," they are neither professional trained nor socially or economically prestigious, their voices and proposals often end up in trash can or leaders' assistant, rarely have the chance to catch attention. This has been true both in the past and the present, in China and elsewhere. But successful examples can still be seen. In 2003, local organizations strongly opposed the hydroelectric project on the Nu River since the river was literally listed as a natural property by UNESCO one month before the National Development and Reform Commission's

[50] Ibid., 41.
[51] Setsuko Matsuzawa, "Citizen Environmental Activism in China: Legitimacy, Alliances, and Rights-based Discourses," ASIA Network Exchange 19 (Spring 2012): 81-91.

approval of the project. They mobilized the media in an effort to win over the public and wrote letters to the leaders of the State Council. Therefore, Wen Jiabao declared the immediate halt of the project for the goodness of the citizens and the protection of the river.[52] The model is showing the change from authoritarian regime to more democratic and willing to listen and answer to the public. This model is expected to be one of the major models for China's future agenda setting.

The Popular Pressure Model

As we move on, public voices were trying to catch even more attention to the government. This model refers to a situation in which a citizen or a group of them submits suggestions on public affairs in the form of any propaganda to central decision makers and the mass public, including complaints or appeals about the interests of an individual or a small group.[53] This model can be seen as the extension of outside access model. As public awareness of certain issues arouses swiftly, the public feel the need for them to inform to the government about their thoughts. Three main features can be categorized: (1) issues emerge from nongovernmental sources

[52] "WenjiabaochurenyiliaozhantingNiJiangshuibaxiangmu" (Wen Jiabao halted the Nu River Dam Project), *Epoc Times*, April 9, 2004. Last accessed: http://www.epochtimes.com/b5/4/4/9/n506057.htm
[53] Frances S. Berry, and William D. Berry, "Innovation and Diffusion Models in Policy Research," *Theories of the Policy Processes* (1999): 169-200.

(2) agenda initiators are not difficult to identify when an issue is first brought forward[54] (3) may not function until an issue turns from the interest of a small attentive public to the public agenda concerning many people. Environmental non-governmental organizations (NGOs) in China plays the essential role of sending the popular pressure to its government. Serving as the bridge between mass public and government, their mission is to let both parties communicate. In other words, to eliminate the information asymmetric between mass public and government.[55] This model is the growing force in China to push the decision-making process more toward public and expected to be one of the major models for China's future agenda setting in many aspects.

The Growing Power of Public Pressure on Environment Issues

For the last decade, China have been pursuing the single-minded highest possible aggregated growth rate. And this has resulted in a whole series of acute challenges. Including environmental crisis, the widening income gap, the lack of economic and

[54] We could identify two groups of public, "attentive public" and "general public." The former one is always a tiny segment of the population, consists of those who are most interested and involved in an issue; general public is the majority of population whose attention to most public issues tend to be transitory and who are seldom involved in policy disputes for long.

[55] Tsai Fuyao, "Huanbao NGO fazhanzhongdemeitijiaosetanxi"(Analysis on the developing media character of environmental NGOs), *Renmin Wang* (People's Web), July 15, 2015. Last accessed: http://media.people.com.cn/BIG5/n/2015/0715/c397479-27308164.html

social security and so on.[56] Now, this is the time for China to change course by pursing more balanced and more coordinated socioeconomic development. Hence, the public pressure from different aspect can be the changing force for China. With some key roles such as associational revolution, the changing role of the mass media, and the rise of the internet, public pressures are able to influence the decision China has made. We separately discussed the three.

The associational revolution.

Over 190,000 associations of various types was registered till March 2007, with government civil affairs departments at the county level and above.[57] Among all the associations, NGOs and environmental groups are the most active associations in China. But at 1990s, pollution was not a grave problem and did not trouble most people. Things began to change, in year 2004, with incomplete statistics, there were at least 2000 environmental NGOs in the nation.[58] Fu Tao, a senior scholar in China suggested, "In year 2003 and 2004, local environmental NGOs have participated many public events with different and vivid characteristics, this indicates that the

[56] Gabriel Wildau, "China Income Inequality Among World's Worst," *Financial Times*, January 14, 2016. Last accessed: https://www.ft.com/content/3c521faa-baa6-11e5-a7cc-280dfe875e28
[57] MinZhengbu, 2007
[58] Hong DaYong, "minjian huanbao liliang chengzhang jizhi yanjiu" (A Study of the Growth Mechanism of Nongovernmental Environmental Protectionist Forces), *Forum of the Friends of Nature*, June 2004. Last accessed: http://www.usc.cuhk.edu.hk/wk_wzdetails.asp?id=3959

NGOs' influential is moving forward into the public. Environmental NGOs have successfully expanded their social effectiveness and pressure through the wide coverage of media."[59] The successful environmental NGOs included Global Village Beijing (GVB) and Friends of Nature (FON) were even enlisted in the Beijing Olympics organizing committee.[60] The involvement of NGOs in the national level committee implied the growing power of NGOs in the decision making progress.

Mass media

Mass media is the direct contact from either government or any types of organizations to the public. With the familiarity of mass media, environmental organizations could manage to affect the decision-making process by spreading the message to the public and thus public pressure was created. In recent years, the Chinese people have shown growing concern about different issue areas such as agriculture, farmers, migrant workers, ecological environment, public health, inequality and others. Mass media then serves as a perfect platform for various social groups to articulate their needs and interests' preferences, and help turning people's

[59] "Huanjingbaofuyugongzhongcanyu: Zhongguohuanbao NGO defazhan" (Environmental Protection and Public Participation: The Development of China's Environmental NGO), *Zhongguo Wang* (China's Net), July 27, 2007. Last accessed: http://www.usc.cuhk.edu.hk/wk_wzdetails.asp?id=3959 http://big5.china.com.cn/aboutchina/zhuanti/lsxd/2007-07/27/content_8590545_2.htm

[60] Timothy Hildebrandt, and Jennifer L. Turner, "Green Activism? Reassessing the Role of Environmental NGOs in China," *Routledge* 41, 2009.

concerns into public issues.

The rise of the internet

The internet has provided another type of mass media for the association to spread their message even faster and slowing changing the activism's landscape.[61] In 1997, China only had 620,000 internet users; at year 2007, this figure skyrocketed to 162 million, an astounding leap by any standard.[62] In between the growth, when the internet population in China exceeded 45 million in 2002, public online discussion increased dramatically. The internet served as an information disclosure platform for people to understand what the government and others are implementing. 2003 was seemed as "the year of online public cyberspace."[63] There are some distinctive features about internet which let it stand out so different as the previous mass media like newspaper. The first one is every person is a potential information provider and receiver. The second one is the number of potential information providers is in the millions rather than in the hundreds or thousands. The figure will expand as the internet population grows. The third one is the information flows in more than one

[61] Guobin Yang, "The Power of the Internet in China: Citizen Activism Online," *Columbia University Press*, 2009.
[62] Yi Shu, "There Are Now as Many Internet Users in China as There Are People in Europe," *Mashable Asia*, January 25, 2017. Last accessed: http://mashable.com/2017/01/25/china-internet-users-731-million/#QnPz1j9PDiq5
[63] Ibid., 41.

direction. Last but not the least, information on the internet can reach every corner of the Earth instantaneously.[64] Opening up the free access has been an issue for China recently because of the widely spread usage of internet, it could cause a turmoil politically and impose pressures on the ruling party. After all, without a doubt, the public pressure decision-making model has become increasingly important and the rise of internet and environmental organizations are also pushing the decision-making toward it. With the three key reasons, public pressure model would inevitably become one of the most influential decision making process from now on.

The Effect of Changing Decision-making Model to Government's Awareness of Environmental Issues

Although the introducing of the public pressure model for decision-making process, environmental concerns is now only paving its way of influencing policies. China is now one of the world's biggest polluters. Yet there are signs of changing underway as the government faces mounting public pressure over environmental degradation.[65] A key documentary called "Under the Dome"[66], which investigated

[64] This could only be true if the infrastructure were done even in the countryside so that the radio region could reach the remote part of a country.
[65] Yanzhong Huang, "Is China Serious About Pollution Controls?", *Council on Foreign Relations,* November 20, 2015. Available on: http://www.cfr.org/china/china-serious-pollution-controls/p37270 (last available on 23 April)
[66] Celia Hatton, "Under the Dome: The Smog Film Taking China by Storm," *BBC News*, March 2, 2015. Last accessed: http://www.bbc.com/news/blogs-china-blog-31689232

China's air pollution and its impact on health, went viral in March 2015. It received about 200 million views on Chinese websites. Just after the release of the documentary, the Chinese Communist Party's Central Committee restated its plan to implement "ecological civilization reforms." Through movie or documentary, a strong mass media, scholars and researchers in China could report the air pollution statistics for citizens in China to trigger the concern about their own ecological environment. But still, these examples are not often seen. Few environmental NGOs in China have the will and capacity to initiate public interest litigations. Unlike another large emerging country, India, environmental NGOs in China tend to be small and lack the means to specialize in both environment and law, not to mention carry out high litigation.[67] By the way, the reluctance of local governments and enterprises to disclose information on the environment surly serves as another reason for the uncommonly-used public pressure model for environmental issues in China. To explain, former two only increase the cost of investigation and evidence collection, which is often used as the basis for deciding whether a case is able to be prosecuted or not. If at the end, the voice of these organizations could not be heard by any levels of

[67] Ashish Chaturvedi, and Hubert Schmitz, "Green NGOs in China and India: Surprising Developments," *Institute of Development Studies*, June 3, 2015. Last accessed: http://www.ids.ac.uk/opinion/green-ngos-in-china-and-india-surprising-developments

the government, public pressure model would not be effective in this field.

Chapter Conclusion

When we discuss about policy outcomes and its future trajectory, the decision-making models are a good reference for us to follow. The models introduced in this chapter coexist in various degrees in China. Compared with Mao's era, the legacy of strongman politics has almost disappeared. Agenda setting now is becoming a more and more scientific and democratic process, thus different models were able to be used in different areas. Andrew even claimed that China is now having the willingness to let citizens influencing the policy decision making at local level.[68] As for environmental issues, public pressure model has been gaining its popularity in the field. But for this model to be successful, the government itself needs to have the same awareness of ecological problem and be responsible for any policies implemented. Collective studies in Politburo of the CPC Central Committee served as a good example that China's central decision makers also held the same awareness toward ecological environment. Xi Jinping said in the 6th collective studies in 2013

[68] Andrew C. Mertha, "China's Water Warriors: Citizens Action and Policy Change," *Cornell University Press*, 2008.

that, “Environmental Protection is the thing you do it now and further benefit future generation.” The words arouse China’s urgent needs to save its citizens from ecological disasters now and to the future. He also called for the emphasizing of environmental issues in 41th collective studies later in May 2017, saying “Protect the ecological environment just like you protect your eyes; treat the environment just like you treat your own life.”[69]

Besides the changing mindsets in central government, more and more people and organizations are putting efforts to disclose and try to let the majority to understand the real ecological situation now in China. From the disclose of PM2.5 measurements of Ambassador Jia Hui Luo to the documentary Under the Dome, signs have showed that the growing consciousness of the public and the rising influence of environmental organizations are creating the public pressure for China to at least alter a little bit more to care about its own ecological environment. As Wen Jiabao announced in 2006, “we emphasize solutions to major problems, either relevant to the grand strategy of the country’s social-economic development or of deep concern to the mass public.” The words from the leader shows the changing attitude of China when

[69] Jing Gao, and Jun Dung, “The Central Spirits of the Collective Studies in the 41th Politburo of the CPC Central Committee,” *Sina News*, May 27, 2017. Last accessed: http://news.sina.com.cn/c/2017-05-27/doc-ifyfqqyh8795729.shtml

making important decision. Although with the words from the top leader, it is not possible for a long-history authoritarian China to listen and dissolve the mass public information in a short period of time. The changing is a slow but gradually ongoing movement. There is still a long way for the public pressure to deeply influence China's decision making. But just as Ma Jun, director of the Institute of Public and Environmental Affairs said, "The pressure needs to come from the public, because the power of the public is large, and they can push forward air pollution control in China."[70]

[70] Agence France Presse, "China Seen Facing Uphill Struggle Against Pollution," *Capital News*, June 17, 2013. Last accessed: http://www.capitalfm.co.ke/news/2013/06/china-seen-facing-uphill-struggle-against-pollution/

Chapter Five: Critical Juncture I: 2008 Beijing Olympics

Introduction

In this thesis, "2008 Summer Olympic Games" and "2014 Asia-Pacific Economic Cooperation (APEC) Summit" are chosen to be the critical juncture for the path dependent analysis. In chapter three, the discussion of why 2008 Olympics suit the definition of critical juncture had already be given. Furthermore, statistics and policy turns will be offered to show the changing of China's attitude toward environmental concerns. In chapter six, same structure will be applied on the second chosen critical juncture: the 2014 APEC Summit in Beijing to illustrate the event.

Critical Juncture (I): The Hosting of 2008 Summer Olympic Games

2008 Beijing Olympics was not the first time China try to bid for the host. China lost the hosting of 2000 Summer Olympics to Sydney at year 1993. After 7 years, Beijing finally beat Istanbul, Osaka, Paris and Toronto and became the host of 2008 Summer Olympics. Beijing Olympics was the 29th Olympic Games, it was the third time being held in Asia and also the third time in socialist country. Exact date was from August 8th to 24th.

The human rights controversies stroke the image of China when this Olympics gave opportunities to both domestic and foreign activists to engage in an "Olympic boycott movement" to protest China's human rights record.[71] Besides the controversies on human rights, environmental issue was severely questioned by foreign media.[72] Beijing's air pollution has troubled the city for many decades. It's socioeconomic structure, meteorological conditions, and some non-Beijing sources (NBS)[73] interwove to create the troublesome and laborious problem of air pollution in Beijing. Since 1978, China has put its pivot on economic development since it was a developing country. For Beijing, heavy industries and coal-fired power plants are building up the economy in this city. Thus, the heavy use of coal created one of the reason for its bad air pollution problem. The air quality in Beijing soon became a great concern to both the Chinese government and researchers.[74] One side of the story for China was to be cheerful that they would have the chance to show its

[71] Richard Baum, "Beijing Recoils Under the Global Spotlight," *Far Eastern Economic Review* (April 2008).
[72] Shai Oster, "Will Beijing's Air Cast Pall Over Olympics?" *The Wall Street Journal*, February 15, 2007. Last accessed: https://www.wsj.com/articles/SB117148719982908969
[73] Sarath Guttikunda, "A Review of Air Pollution from Transport Sector in China," *SIM-air Working Paper Series*, 2009. Available on: http://www.urbanemissions.info/wp-content/uploads/docs/SIM-19-2009.pdf
[74] T. Wang, W.Nie, J.Gao, L.K.Xue, X.M.Gao, X.F.Wang, J.Qiu. C.N. Poon, S. Meinardi, D. Blake, S.L. Wang, A.J. Ding, F.H. Chai, Q.Z. Zhang, and W.X. Wang, "Air Quality during the 2008 Olympics: Secondary Pollutants and Regional Impact," *Atmospheric Chemistry and Physics* 10, (2010): 7603-7615.

national power for hosting this mega-sport event; on the other side of the story, athletes and media were concerned about the air pollution problem in Beijing because the smog might harm the athletes who came to Beijing and thus affected their performance during the time they fought over national pride. Thus, Beijing Organizing Committee for the Games of the XXIX Olympiad (BOCOG)[75] were created to develop and supervise the stage of Beijing's air cleansing.

Many policies were implemented to better the air pollution in Beijing before 2008 Olympics, including traffic control over odd and even car plate, moving coal-fired plants out of Beijing and limit governmental usage of electricity and etc. All these measures were unprecedented and proven to be the important sources of air cleansing in Beijing during the 2008 Olympics.

Statistics of Air Pollution Data Before, During and After the 2008 Olympics

Some major indexs could tell the story of the air pollution prevention results for 2008 Olympics. Those index includes Air Pollution Index[76] (API) and Aerosol

[75] Beijing Organizing Committee for the Games of the XXIX Olympiad (BOCOG): established in 2001 December 31, the organization was responsible for preparing the Games, including infrastructure development, environment improvement, public relation, and logistics. The slogan for 2008 Olympics was "Green Olympics, High-tech Olympics and People's Olympics."

[76] Air Pollution Index (API): issued by State Environment Protection Agency (SEPA) with the monitoring data of suspended particulate matter (PM10), sulfur dioxide and nitrogen dioxide. In overall API, if API is below 50, it si defines as excellent, 50-100 as good, 100-200 as slightly pollutes, 200-

Optical Depth (AOD).[77] Data for API came from Ministry of Environmental Protection (MEP) in China, and the other AOD data could be found from Moderate Resolution Imaging Spectra-radiometer (MODIS) in NASA. Since China didn't allowed individual researchers to access in situ pollutant measurements, some scholars even doubt the authenticity of the API data from Chinese government. On the other hand, AOD is an objective measure retrieving from satellite data which could never be wrong.[78] Thus, from the upcoming statistics of API and AOD, both of the figures indicated the identical decreasing phenomenon. Hence, the numbers offered by MEP should be considered as useful rather than only showing the extreme-best situation of air condition in Beijing. For both API and AOD index introduced in this paper, the information comes from Yuyu Chen at el.'s paper and other paper's data will serve as prover and supportive information. Different numbers of API have their own interpretation of air pollution degree, table one will indicate the different

300 as moderately polluted and 300+ as heavily pollution. Below 100 is also called "Blue sky days." The API index also have strong seasonal variation which is higher in winter and lower in summer because of meteorological conditions in Northern part of China. Hence, summer Games would have better API index. Part of the reason could be driven by season.

[77] Aerosol optical depth (AOD): aerosols are tiny solid and liquid particles suspended in the atmosphere. The satellite measurements of aerosols are called aerosol optical thickness (or depth). They based on the fact that the particles change the way the atmosphere reflects and absorbs visible and infrared light. An optical thickness of less than 0.1 indicates a crystal sky with maximum visibility, whereas a value of 1 indicates very hazy conditions. More information on: https://earthobservatory.nasa.gov/GlobalMaps/view.php?d1=MODAL2_M_AER_OD

[78] Yuyu Chen, Ginger Zhe Jin, Naresh Kumar, and Guang Shi, "The Promise of Beijing: Evaluating the Impact of the 2008 Olympic Games on Air Quality," *National Bureau of Economic Research (NBER)*, (March) 2011.

standards of API and their meaning.

In this analysis, API data is divided into four time categories: before the game, during the game, after one month of the game, and after ten month of the game. First category was set at the time one year before the setup of BOCOG in 2001; the second category was determined as the seven-years preparation period from 2001 to 2008; the third category was then set one month during the Olympics in August and September 2008; the last category shows the data 13 months after the Games which is around November 2009.

API	Pollutant intensity			Air Quality Level	Air Quality Condition	Notes of health effects
	TSP	SO_2	NO_2			
500	1000	2620	940	V	Heavy Pollution	Exercise endurance of the healthy people drops down; some will have strong symptoms. Some diseases will appear
400	875	2100	750			
300	625	1600	565	IV	Moderate Pollution	The symptoms of the patients with cardiac and lung diseases will be aggravated remarkably. Healthy people will experience a drop in endurance and increased symptoms.
200	500	250	150	III	Slightly Polluted	The symptoms of the susceptible is slightly aggravated, while the healthy people will have stimulated symptoms.
100	300	150	100	II	Good	Daily activity will not be affected.
50	120	50	50	I	Excellent	Daily activity will not be affected.

Table 1: Different API Index and its Corresponding Conditions

The data covered from 2000 to 2009 for the whole discussion of the air pollution situation for Beijing Olympics. The data not only collected Beijing city, but also five cities that co-hosted the Games in other parts of China and three cities surrounding Beijing that adopted measures to improve air quality in and around Beijing. Figure one shows the overall flow of API index.

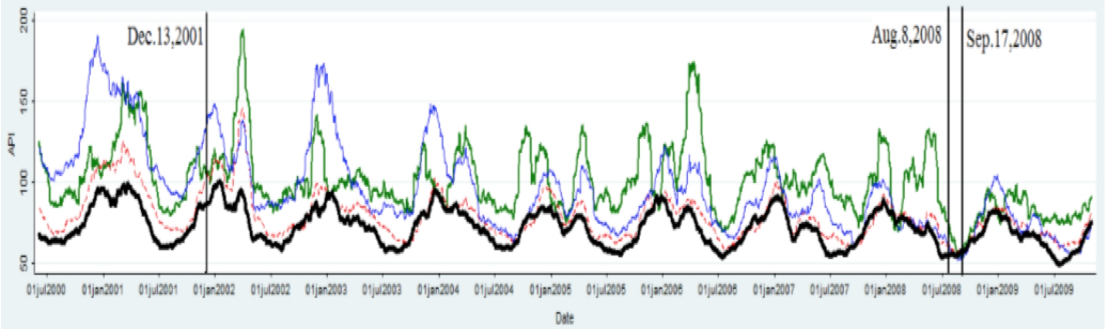

Figure 1 : Time Series of API Index for Beijing and Co-host Cities

Beijing (Green), Co-host Cities (Red-dotted), Neighbor Cities (Blue), Control Cities (Black)

After understanding the overall flow, let's specifically look into the data for the four categories during 2008. The number for first session is 109.01 then we can observe a major declined in the second session with the number of only 77. The attenuated trend was most attributable to plant closure and traffic control. During and short time period after the Games, the figure slightly came back to 82.5. After a year, numbers bounced back to nearly 100 compared to the Games. To sum up the overall

reduction progress for the Games, 41% of SO_2 was cut down; 47% for NO_x and 55% cut of PM_{10} were also suggested in a more recent study.[79] On one aspect, we could clearly observe the annual fluctuation during 2001 to 2008. Most of the high figure happened during winter time, indicating that meteorological conditions were essential determinants for API index in Beijing. In the winter, coal-burning facilities were doing its job to keep the city warm, hence higher API index could be expected. The index suggested the lowest record during the Olympics, saying that the measures implemented to fight air pollution in Beijing actually worked.

Analogous results happened in AOD measurements. Figure two indicated that the AOD index began to decline before the Games, continued to decline during the Games and reached the lowest level months after the Games. What's worth a look is the figure also revert during spring 2009. For Chen at el., the air quality improvement for Beijing was certainly real but also temporary.

[79] S.X. Wang, M. Zhao, J. Xing, Y. Wu, Y. Zhou, Y. Lei, K.B. He, L. X. Fu, J.M. Hao, "Quantifying the Air Pollutants Emission Reduction during the 2008 Olympic Games in Beijing," *Environment Science Technology* 44, (2010): 2490-2496.

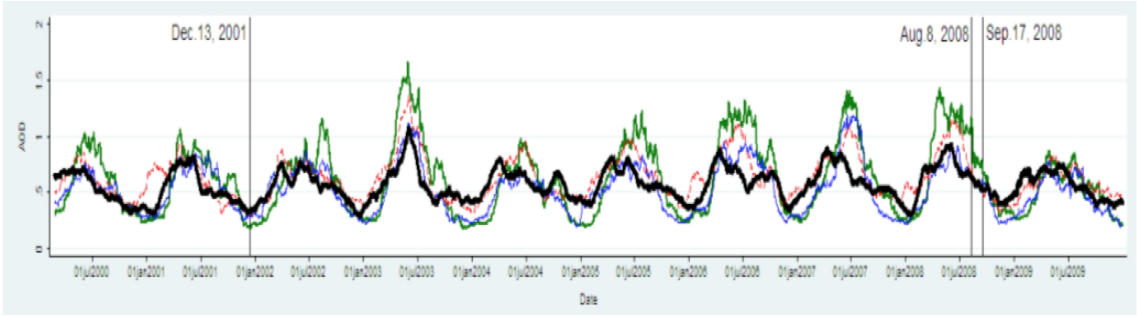

Figure 2: Time Series of AOD Index for Beijing and Co-host Cities

Beijing (Green), Co-host Cities (Red-dotted), Neighbor Cities (Blue), Control Cities (Black)

Policies Implemented

As mentioned before, several new policies were implemented to clean Beijing's air in order to successfully run the 2008 Olympics. These measures included power plant restrictions, traffic control, furnace renovation and new automobile emission standard. Some control measures taken and planned before 2008 in Beijing's power plant including fuel substitution, flue gas desulfurization, dust control improvement and flue gas denitration. These will greatly mitigate the pollution at the same time as energy supply expansion.[80] Move on, the effectiveness of the control measures on reducing vehicle emissions could be observed through the statistics of the decline of NO_x and other 20-45% decreases for typical compounds[81] for vehicular emissions.[82] Even stricter restrictions were implemented at year 2008 to boost the effect in short

[80] Jiming Hao, Litao Wang, Minjia Shen, Lin Li, Jingnan Hu, "Air Quality Impacts of Power Plant Emissions In Beijing," *Environmental Pollution* 147, (2007): 401-408.
[81] These compounds are ethane, ethyne, benzene, toluene, ethybenzene and xylenes.
[82] Ibid., 78.

time.[83] For control of vehicle emission, China adopted new emission standards on March 1, 2008 and restricting on-road vehicles to half based on even or odd vehicle registration number since 2007. All the transportation control measures together formed so called Olympic Traffic Demand Management (TDM), it is concluded that the TDM policy was inextricable with the reduction effect on the hourly traffic flow, with an average reducing rate of 32.3%.[84] Even after the game, a weaker form of traffic control continued as each registered vehicle was required to be off the road one weekday per week.[85] Beijing was not the only city to implement the traffic control, co-host and neighbor cities also adopted the similar measures to improve air quality. Plant closure and traffic control effectively reduced the API by almost 30% during the Games as compared to one year before any Olympic-motivated actions were carried out. The number of days of meeting Air Pollution Standard II or better increased from 56 days in 1998 to 254 days in 2005.[86]

[83] Ting Wang, Shaodong Xie, "Assessment of Traffic-Related Air Pollution in the Urban Streets Before and During the 2008 Beijing Olympic Games Traffic Control Period," *Atmospheric Environment* 43, (2009): 5682-5690.
[84] Ibid.
[85] Mao Baohua, "Analysis on Transport Policies of Post-Olympic Times of Beijing," *Journal of Transportation Systems Engineering and Information Technology* 8 (2008): 138-145.
[86] X. An, T. Zhu, Z. Wang, C. Li, Y. Wang, "A Modeling Analysis of a Heavy Air Pollution Episode Occurred in Beijing," *Atmospheric Chemistry and Physics Discussion* 6 (2006): 8215-8240.

Chapter Conclusion

From this chapter, we could conclude that international mega event such as 2008 Olympics which was not originally meant for cleaning the air in Beijing, could actually ease Beijing's air pollution problem. The sharp reduction in total CO, SO_2 and reactive aromatics suggest the success of the government's efforts in reducing emissions in Beijing.[87]

After the 2008 Olympics, Achim Steiner, the executive director from United Nations Environment Program (UNEP) said during the global environment forum in 2009, "I believe that Beijing will become more sustainable in many aspects and build its green economy using its Olympics' environmental blueprint."[88] China itself also reported that using Beijing as a turning point, a series of pollution control measures were implemented to realize the improvements of air quality.[89] From the view of past dependent, the critical juncture did happen, and also the policy did change. But the figures indicating that the improvement bounced back after a year as the event end. Hence, short term goals for Beijing can obviously be achieved according to the

[87] Ibid., 77.
[88] "Lianheguohuanjingshugoadupingjiabeijing 'luseaoyun.'" (UNEP held high evaluation on Beijing's Green Olympics), Beijingshhuanjingbaohuju (Beijing Municipal Environmental Protection Bureau).
[89] "2008 nianwoushidabiaotianshubiqunianduo 28tian kongqizhilianglianxu10niangaishan," (Good Air Quality Days in Beijing Increased 28 Days in 2008 The Air Quality Has Been Gradually Improving for Consecutive 10 Years) Beijingshhuanjingbaohuju (Beijing Municipal Environmental Protection Bureau).

Olympics experience. However, for a much longer period such as ten years or even the overall average air quality improvement in Beijing, much more efforts still need to be put into the future policies.

Before the next critical juncture in 2014, events happened domestically in Beijing stirred the enormous public backslash. The $PM_{2.5}$ statistics provided by American Embassy in Beijing triggered the chain reaction of discussion in the two very different PM statistics from China and the US. Ambassador Lou Jiahui's decision of publicizing the information led to the self-reinforcing effect for the mass public to question and declare the rights to know about the difference between the two indicators. Also ambassador Lou didn't think of the event as US's action toward China but the rising environmental awareness of citizens and even the governmental newspaper.[90] Hence, when 2014, the next critical juncture hit again in Beijing, stricter restrictions were being placed for fulfilling the mission of short term air cleaning during the juncture.

[90] "Lou Jiahui's Chinese Time." Nan Fang People (NFPeople). November 21, 2013. Last accessed: http://media.sohu.com/20131121/n390543487.shtml

Chapter Six: Critical Juncture II: 2014 APEC Summit

Introduction

After five years since the 2008 Beijing Olympics, 2014 APEC Summit in Beijing also created a critical moment for Beijing to clear its sky. The 22nd annually gathering of leaders in the pacific area provided Beijing another momentum for implementing mitigation policy.[91] Some similarities can be observed between the 2014 APEC Summit and 2008 Olympics. First, they were both international event that were paid highly attention on; second, both events were held in Beijing, so the air pollution problem came to surface; third, the major goal of both events were not showing the environmental protection determination of China but for either the disclose of China's soft power or the stability of political and economic situation in Asia-pacific region. These similarities gave out the reasons for why choosing the Olympics and APEC Summit as the critical juncture for Beijing's air pollution problem. This chapter will show the endeavor which China implemented before the 2014 APEC Summit for cleaning up Beijing's air pollution.

[91] Lu Hui, "China Focus: Beijing to Adopt Strict Air Quality Plan for APEC," *Xinhua English News*, October 14, 2014. Last accessed: http://news.xinhuanet.com/english/china/2014-10/14/c_133715960.htm

Critical Juncture (II): The 2014 APEC Summit in Beijing

The similar situation seemed to happen again when the APEC Summit was held. Thus, the summit was chosen to be the second critical juncture for Beijing's air pollution problem. Since the 2008 Beijing Olympics, the 2014 APEC Summit was the biggest event held in Beijing. Compared to the Summer Olympics when favorable meteorological conditions played an important role in reducing the concentrations of air pollutants, APEC was held in the middle of November when meteorological conditions worsened.[92] The exact date of 2014 APEC summit was during November 3rd to 11th. It was extremely closed to the official winter heating schedule in China which began in the middle of November[93]. Historically, the air quality in Beijing during the heating season was the worst compared to the rest of the year because of the enhanced consumption of fossil fuel especially coal and high frequency of stagnant weather.[94] Thus, it was more challengeable to achieve good air quality during the APEC than 2008 Olympics. It is worth a deeper look to the statistics to know about the more serious policies China offered for cleaning Beijing's air for 2014

[92] Kan Huang, Xingying Zhang, Yanfen Lin, "The APEC Blue Phenomenon: Regional Emission Control Effects Observed from Space," *Atmospheric Research* 164 (2015): 65-75.
[93] The heating season in Beijing normally starts on November 15th and ended on March 15th.
[94] Yu, L., Wang G., Zhu, G., Zhang, R., "Characteristics and Sources of Elements in Atmospheric Particles Before and During the 2008 Heating Period in Beijing," *Acta Scientiae Circumstantiae* 30 (2010): 204-210.

APEC Summit. More than 20 world leaders, including U.S. former president Barack Obama, Vladimir Putin and Shinzo Abe of Japan, will attend the major international meeting to discuss regional trade and investment details.[95] Beijing officials would not allow the embarrassment of the bad city air conditions.

Statistics of Air Pollution Data Before, During and After the 2014 APEC Summit

In this chapter, three types of indicators will be given to show the air quality improvement during the 2014 APEC Summit period. The three indicators are "$PM_{2.5}$", "good air quality days", and "NO_2 concentration." The sampling time periods were cut into three: T1, T2, T3. T1 is the "pre-APEC" time area which is from 20 to 31 October 2014; T2 is the "APEC period" time area which is from 1 to 12 November 2014; T3 is the "post-APEC" time area which is from 13 to 24 November 2014. The main statistics in this chapter is from Wang et al.'s paper.[96]

First, we identified the main pollutants again in the study. From Table 2, we can tell from the mean value that $PM_{2.5}$, NO_2, and PM_{10} are the main pollutant in the study

[95] Jonathan Kaiman, "Beijing Attempts to cut Air Pollution for APEC Summit," *The Guardian*, November 4, 2012. Last accessed: https://www.theguardian.com/world/2014/nov/04/beijing-smokescreen-hide-pollution-apec

[96] Hongbo Wang, Laijun Zhao, Yujing Xie, and Qingmi Hu, "'APEC Blue'- The Effects and Implications of Joint Pollution Prevention and Control Program," *Science of the Total Environment* 553 (2016): 429-438.

period. Pollutants also have strong correlation with each other. For $PM_{2.5}$, strongest correlation was detected with PM_{10}, CO, and NO_2. For PM_{10}, on the other hand, has stronger correlation with NO_2, CO, and $PM_{2.5}$. The higher the correlation between PM and NO_2, CO is, the stronger evidence that combustion-related process such as fuel combustion, industrial production, and vehicle exhaust emission have direct relationship with air pollution problem in Beijing.[97]

	$PM_{2.5}$	PM_{10}	SO_2	NO_2	CO	O_3
Mean	92.89	98.09	12.51	59.83	1.28	20.81
Standard Deviation	78.67	67.23	8.35	25.13	0.73	12.61
Coefficient of Variation	0.85	0.69	0.67	0.42	0.58	0.61

Table 2: Descriptive Statistics for the Six Pollutants in Beijing Throughout the 36-day Study Period

After pointing out the main pollutants, let's look into the different pollutants separately. One can simply see the downturn of PM concentration in both $PM_{2.5}$ and PM_{10} in the T2 time period which respectively showed in figure 3 and 4. The red dotted line is the mean value of each statistics and only in the T2 time period, the red dotted line is lower than the black dotted line which represent the mean value of the corresponding period in previous year. One could also speculate a more stringent and

[97] Pavlos Kassomenos, Sotiris Vardoulakis, Archontoula Chalonlakou, Anastasia Paschalidou, Georgios Grivas, Rafael Borge, and Julio Lumbreras, "Study of PM_{10} and $PM_{2.5}$ Levels in Three European Cities: Analysis of Intra and Inter Urban Variations," *Atmospheric Environment* 87 (2014): 153-163.

complex measures were taken at the time period so that the air quality could improve in such short period.[98] One other phenomenon need to be mentioned is the bounce-back of numbers in both $PM_{2.5}$ and PM_{10} after T3. T3 time period covers the official heating season for Beijing thus the heavy use of coal and other types of fossil fuel would inevitably cause the number to rise.

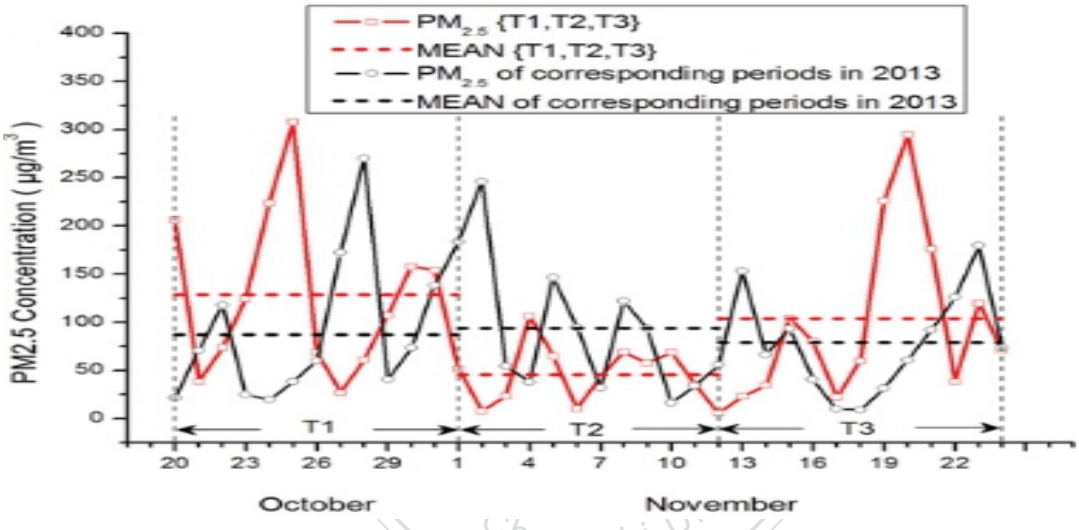

Figure 3:PM2.5 Concentration Data During 2014 APEC Summit

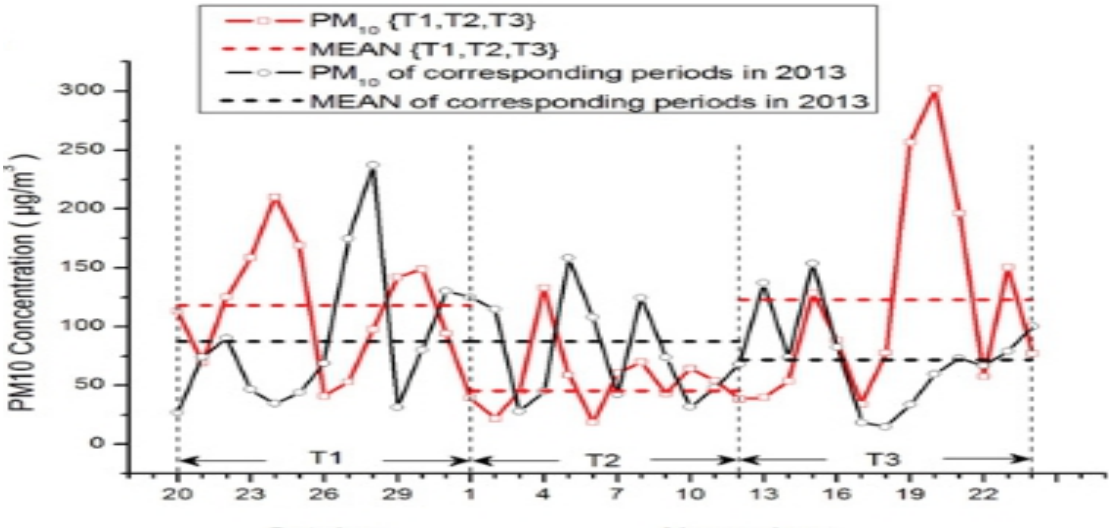

Figure 4:PM10 Concentration Data During 2014 APEC Summit

[98] Rowe Walker, "China Tightens Air Pollution Standards," *China & US Focus*, October 17, 2013. Last accessed: http://www.chinausfocus.com/energy-environment/china-tightens-air-pollution-standards/

Other pollutants such as SO_2 and NO_2 also experienced great decline during the Summit. Figure 5 and 6 shows that the lowest concentrations were both in T2 and the mean value (red dotted line) during that time was also lower than the previous year (black dotted line). This signifies that atmospheric pollution during the 2014 T1 and T3 phases was worse than that during the corresponding 2013 phases and that if no measures had been enacted, the pollution during the 2014 T2 phase would also have been worse than that during the corresponding 2013 phase.[99]

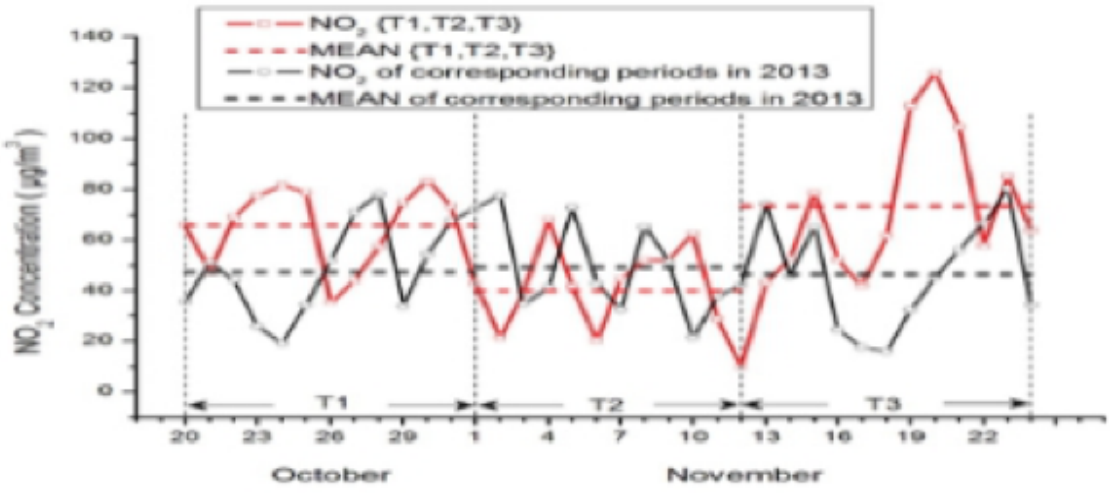

Figure 5 NO_2 Concentration During the 2014 APEC Summit

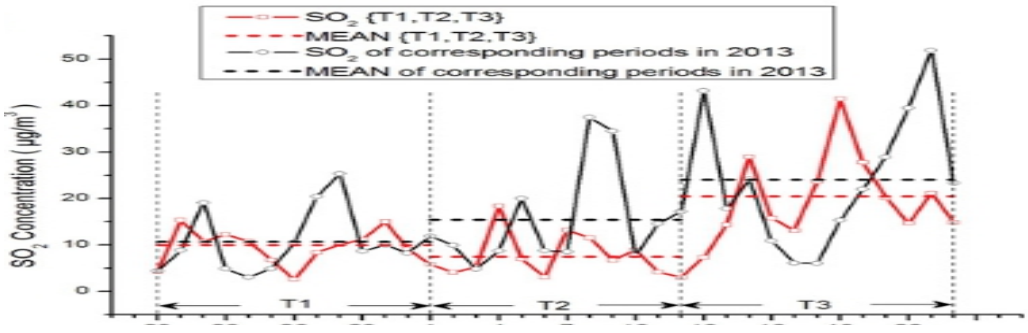

Figure 6:SO_2 Concentration During the 2014 APEC Summit

[99] Ibid., 96.

Another well-shown chart shows the “good air days” in different time period around the APEC Summit time (see figure 8). Compared to T1 and T3, twelve days in T2 only consisted of one day that was categorized as lightly polluted. Other days were all with moderate or even better air quality.

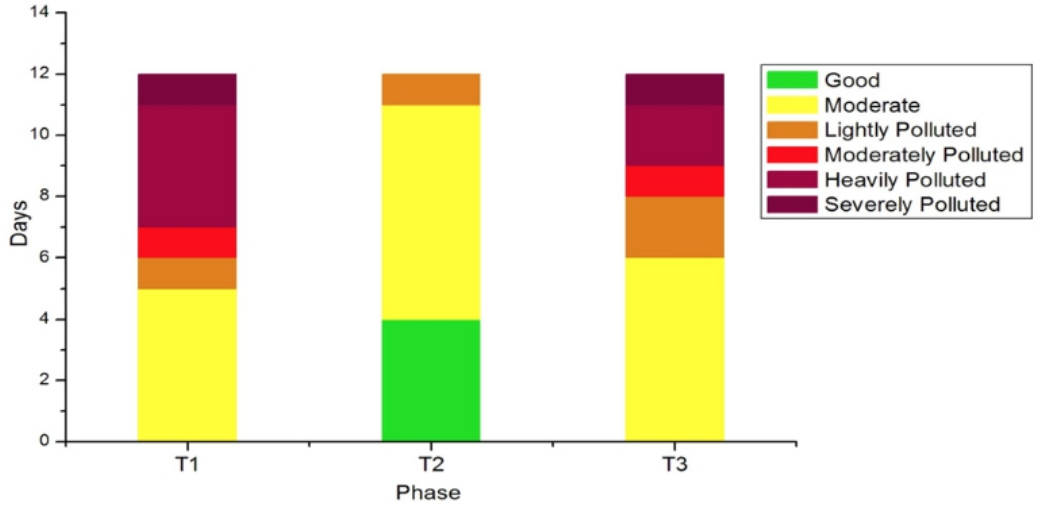

Figure 7:Good Air Quality Data During the 2014 APEC Summit

T1 and T3 only had less than half days being categorized as moderate, even “heavily severely polluted days” were seen on both periods.

Overall, the research didn’t find significant differences of meteorological conditions between 2014 and the other years, which suggested that the changes of ambient air pollutant concentrations presented above should be mainly ascribed to the emission control methods. Although the mitigation measures against air pollution were proved a success during the short period of the Olympics and APEC Summit,

but long term and sustainable improvement of air quality in Beijing remains a great challenge for China.[100]

Policies Implemented

Same as 2008 Olympics, stricter implementations of regulations were given before the meeting. The difference between 2008 Olympics and 2014 APEC Summit was the duration of the implementation. For 2014, much shorter duration was given thus if we could observe immediate improvements during the APEC Summit, that implies the measures taken were very useful and effective. According to Wang et al., Beijing emission reduction measures taken for 2014 APEC Summit were deemed "the strictest measures in the history."[101] Joint prevention and control measures were implemented throughout T2 phases to ensure the air quality in Beijing region is good enough for meeting the "good" standard. Besides the same policies package such as limitation of car on-road by odd or even car plate and power plant shut-down as 2008 Olympics, special measures were also taken to enhance the cleaning effect. These

[100] Hainan Yang, Jing Chen, Jiaojiao Wen, Hezhong Tian, and Xingang Liu, "Composition and Sources of $PM_{2.5}$ Around the Heating Periods of 2013 and 2014 in Beijing: Implications for Efficient Mitigation Measures," *Atmospheric Environment* 124 (2016): 378-386.
[101] Ibid., 94.

measures included shut-down of all Beijing building sites, free to take bus for citizens in Beijing, prohibition of outdoor barbeque and waste incineration, and a 6-days-vacation for institutions and schools from 7 to 12 November.[102] Beijing residents were even encouraged to travel outside the city such as nearby Henan province with the offered discounts or free tickets.[103] According to reported statistics, traffic flows in Beijing decreased about 20% during the APEC period because of this policy.[104]

Chapter Conclusion

This time in 2014 APEC Summit, Beijing showed again its determination on air quality improvement. From path dependent point of view, 2014 APEC Summit was a unique moment to use path dependent to test whether China has changed its policies toward a more active voice. From the above statistics, the average concentration of $PM_{2.5}$, PM_{10}, NO_2 clearly decreased compared to the values in the corresponding phases on 2013, proving the measures to be effective. The statistics were then compared to the situation if no actions were taken before the Summit. The actions

[102] Kit Tang, "Thanks to APEC, Beijing Gets Another Golden Week," *CNBC*, 5 November (2014). Last accessed: http://www.cnbc.com/2014/11/05/thanks-to-apec-beijing-gets-another-golden-week.html
[103] Zheping Huang, "G20 to the Olympics. Just like Beijing," *Quartz Media*, August 30, 2016. Last accessed: https://qz.com/768676/how-to-host-a-successful-international-event-from-the-g20-to-the-olympics-just-like-beijing/
[104] Ibid., 88.

contributed the 30% decline of $PM_{2.5}$ average from November 1 to 12.[105] But meanwhile, same worries came after the Summit when we observed the bouncing figure after the event indicating that these measures only caused short term effect. Domestically, after a year in February 2015, the most influential environmental documentary "Under the Dome" by Chai Jing caused China and its people to rethink about the ecological disasters that had been mooted previously. This time, even the governmental-environmental bureau in China concurrently supported the documentary. This event, again, proved the self-reinforcing effect after the critical juncture to be ancillary for the changing mindset of environmental issues in China.[106]

After the meeting and the documentary, China's National People's Congress Standing Committee approved the Atmospheric Pollution Prevention and Control law which will come into force on January 2016. The State Council also made a five-year national action plan to control $PM_{2.5}$ pollutions in Beijing-Tianjin-Hebei, Yangtze Delta, and Pearl Delta through ten integrated pollution control measures.[107] Even a

[105] "'APEC Lan' weizhongguozhilidaqiwurandailaiqishi" (APEC Blue Brought Important Message to China's Control Measures of Atmospheric Pollution), *Beijing Municipal Environmental Protection Bureau*, November 17, 2014.

[106] Yueran Pan, "Special Report: The Government and Politics Behind Chia Jing's Smog Investigation," BBC Chinese, March 6, 2015. Last accessed: http://www.bbc.com/zhongwen/trad/china/2015/03/150306_view_chaijing_politics

[107] Xuejun Liu, Yunhua Chang, Weifeng Zhang, Peter Vitousek, Pamela Matson, and Fusuo Zhang, "Evidence for a Historic Change Occurring in China," *Environmental Science & Technology* (2015).

national monitoring network for $PM_{2.5}$ that will cover 190 cities with a total of 959 national monitoring network will provide detailed information on the $PM_{2.5}$ dynamics and the effectiveness of pollution control implemented through the updated Atmospheric Pollution Prevention and Control Law.[108] These follow-up policies appeared after the Summit showed the growing awareness of China on its air pollution problem. Though "APEC Blue" experiment revealed potential pathways for short-term regional air pollution control, knowledge-based efforts to reduce emissions without economic disruptions like closing factories offer a more promising pathway to environmental protection in the long run.[109]

[108] Ibid.
[109] Ibid.

Chapter Seven: Using Path Dependent Analysis

We have to look into some policies to see if China truly has been through a change because of the critical junctures to serve as the theoretical basis for utilizing path dependent analysis. Thus, several policies were chosen for analysis. First, the consecutive FYP from 10th through 13th. Then some important air pollution control policies including National Environmental Protection Standard, Air pollution Control Action Plan, and etc. Last, we look at the local air pollution governance in Beijing which almost be in the lead of national policies.

National FYP

The five-year-plan policies are the most important policy guidance to observe the policy trajectory. It lays out China's development strategies, clarifies the government's working focus and provides guidance for the activities of major market actors.[110] The preparation period for 2008 Olympics crossed the 10th and 11th FYP; on the other hand, 12th and 13th FYP could serve as good comparing examples for 2014 APEC Summit since the time was in between the two FYPs. By looking into the very essential and core value of China's FYP we can understand the pivot of China's

[110] Xinyan Lin, and Mark Elder, "Major Developments in China's National Air Pollution Policies in the Early 12th Five-Year Plan Period," *IGES Policy Report* No. 2013-02, 2014.

policy.

10th and 11th FYP

We only take observation from the chapters that considered sustainable development and pollution control issues. In 10th FYP, the chapter was called "Population, Resources and Environment." By the name, one can infer that the main sustainable development goal was to control the population growth rate[111]. In the same chapter, the policy also mentioned the forestry coverage rate that needed to be increased by the number of 18.2%. Other details include water resource usage and control over industrial pollution were also mentioned in the policy. But the overall main goal was to keep the GDP growth rate in higher speed to keep the development.[112] Nothing about air pollution control methods were mentioned in the policy. The sustainable development goal was basically controlled by population index.

However, during the 11th FYP which regulated from 2006 to 2010, had much more substantial policies toward air pollution and environmental achievement

[111] In the 10th FYP, the population growth rate was expected to be controlled in 9%.
[112] "The Tenth Five-Year-Plan," Zhongguowang (China Net). Last accessed: http://www.china.org.cn/english/features/38198.htm

assessment regulation.[113] The chapter in 11th FYP was written as "Building a resource-efficient and environmental-friendly society." The basic environmental protection policy was to conserve energy, water, soil and other materials. Some more detailed policy such as the formulation of environmental achievement assessment and responsibility mechanisms that encourage the mass public to participate and supervise into the environmental policies. Local leaders now are no longer judged only by their economic performance alone, but also their environmental performance, for example, water and air quality.[114] The system of environmental supervision talks (EST) was introduced to China in year 2007 under the 11th FYP period. The talk serves as the dialogues between Ministry of Environment Protection (MEP) and six regional supervision center (RSC). The talk had successfully led to the suspension of operations for 57 major polluters in the city of Linyi.[115] Later in post-2014 EST summon local heads of government and encourage media coverage. The publicity of the talks produces pressure on local officials to produce visible effects. This summon can be explained by the public pressure decision making model mentioned in the

[113] C. Cindy Fan, "China's Eleventh Five-Year Plan (2006-2010): From "Getting Rich First" to "Common Prosperity"," *Eurasian Geography and Economics* 47 (2006): 708-723.
[114] Elizabeth Economy, "Environmental Governance: The Emerging Economic Dimension," *Environmental Politics* 15 (2006): 171-189.
[115] Yanzhong Huang, "Is China Serious About Pollution Control?" *Council on Foreign Relations*, November 20, 2015. Last accessed: http://www.cfr.org/china/china-serious-pollution-controls/p37270

previous chapter. It is especially true when new CCP rules that hold party and government leaders principally responsible for ecological conditions and environmental protection.[116] There was also a specific chapter on "enhancing atmospheric pollution control." The mentioned measures included desulfurization of current coal-fired power plant, prohibition of newly-built and extension project of energy-intensive industries such as steel and smelting. From 10th to 11th FYP, a huge difference between the lines indicated the very fundamental idea changes in China.

12th and 13th FYP

The story continued to 12th FYP, since 2011, it was the first time for China to use words "to face global climate change" in their policy but at the same time, as it's still categorized as a developing country, insists on common but differentiated responsibilities. The title of the chapter was basically the same as previous 11th FYP, but included more information on flood control capacity, earthquake disaster prevention and relevant technological breakthrough. The aim was to be able to face the global climate change and alleviate the casualties of sudden natural disasters for

[116] Ibid.

the goodness of China's citizens.

The most positive policies were placed in the 13th FYP. The chapter was than written down as "Improving the ecological environment." Even from the name of the relative chapter can we infer the growing awareness and substantial movements in China. In the 13th FYP, different subjects were put into specific sections for discussion unlike the overall and principle rules which were offered in the previous FYPs. For example, in the 11th and 12th FYP, the idea about "environmental comprehensive governance" was brought out but didn't include any specific regulations. In the 13th FYP, the discussion about environmental comprehensive governance brought out the plan to achieve certain level of air quality index in the big cities and reduce 25% of the bad-air days in total, simultaneously emphasizing the importance of local government's responsibility of their own environment by implementing environmental inspection and assessment.

In the 13th FYP, common but differentiated responsibilities was still mentioned once to make sure they shoulder the corresponding responsibility according to the nation's condition. Instead of just stating itself as a developing country, many other substantial actions were brought out in the paper. Under the main sustainable

development goal of "improving environmental quality and solving the ecological problem," critical programs were set up for meeting its goal.

The first one was the carbon emission report for specific units. The report was required to have the information about the emission statistics, quota managing system[117], inspection and target responsibility system[118]. The second one was the atmospheric environment governance. The FYP specifically mentioned three areas that have urgent needs for air quality improving. These areas were Jing-jin-ji, Pearl river delta, and Northeast area. Also, actions such as accelerating Mei-gai-qi （煤改氣）[119]program and eliminating yellow-label cars[120] were considered the first to be implemented. Last but not the least, developing energy efficient and environmental friendly enterprises to verify green purchase, green finance, green government bonds

[117] Tradable pollution rights are one of the quota managing system in China. Till 2015, China has set up more than 20 local trading platforms that allow companies to buy and sell emission of pollutants. This pollution-rights trading scheme received a new boost in September 2015 when Beijing's reform plan emphasized using market mechanisms to address the country's environmental problems. Yet, firms didn't have incentives for the trade. Not a single trade was made in Beijing's platform. Thus, the quota system remains as a research gap in the future.

[118] "Dashoubizhilikongqiwuran, kongqishengtaibuchangnengfouzhibiaoyouzhiben?" (Can the Compensation for Air Pollution Improvement Truly Solve the short-term and the long-term Air Pollution Problem?), Ministry of Environmental Protection of the People's Republic of China (MEP). Last accessed: http://zfs.mep.gov.cn/hjjj/hjjjzcywxz/201606/t20160621_354893.shtml

[119] In the Air Pollution Prevention and Control Law drafted a target responsibility system and an evaluation system. See more on: http://www.npc.gov.cn/npc/xinwen/lfgz/flca/2014-12/29/content_1891880.htm

[120] Definition of "yellow-label" cars: gasoline-fueled car which can't reach national I emission standard and diesel-fueled car which can't meet national III emission standard. These cars have yellow label signs, hence the name. Another classification could be cars that purchased before 1999, before Beijing began to execute the national I emission standard. More information in: http://car.autohome.com.cn/shuyu/detail_40_41_204.html (In Simplified Chinese)

and etc.

The overall changing of 10th to 13th FYP is presented below in appendix 2.

Other Important Environmental Policies

After 2008, several essential national policies were made to further improve the air pollution problem in China. These acts include 2012 National Environmental Protection Standard, 2013 “Air Pollution Control Action Plan”, 2014 “Environmental Protection Law” and 2015 “Air Pollution Control Law”. In the latter two, other than regulating emission measures and criteria, information disclosure to the mass public and possible participation also for the mass public. In “Environmental Protection Law,” a specific chapter (chapter five) were written for the information disclosure and public participation, indicating that citizens, legal entities and organizations have the rights to participate and supervise government’s actions on environmental protection (§53) as well as the rights to report to higher-position department of environmental protection for inactions of its local government (§57). Same in the “Air Pollution Control Law,” sentences such as soliciting opinion from relative organizations, enterprises and the public beforehand appears more than four times. Words including the statistics and information needs to make public to the majority appears even more

than 10 times in the law. These signs are showing that the opinion and power from the mass public is gaining its influence to the central government, public pressure model once again shows its growing force in China.

Local Governance in Beijing

Responding to central government's policy, Beijing local government spared no efforts on environmental governance. As early as 1998, Beijing city already had the annual air cleansing plan but the upgraded air pollution control measures after the hosting of 2008 Olympics gave prominence to Beijing's determination of fighting air pollution. Not only to achieve the requirements from International Olympics Committee (IOC) but also to make sure the health and well-being of Beijing's citizens.

After Beijing Olympics, the progressive actions toward air pollution control and the "Green Beijing" spirit had planted in its 2009 air cleansing action plan to keep improving Beijing's air. Also in Beijing's "12th Five-year Plan and Rules Toward Environmental Protection," mentioned the success of air pollution control before and during the Olympics which needs to be sustained and realizes in future relative policies. Beijing's 12th FYP also aimed to develop the new goal as becoming a world

city with Chinese characteristics and continued its "Green Beijing" strategy and paid more attention to ecology. In year 2013, Beijing also prolonged its action plan into a four-year plan which covered until 2017. Moreover, Beijing put the atmospheric pollution control regulations into law even before central government. After the realization of the law, several main changes occurred including new follow-up policies[121], punishments for illegal emission actions[122], and innovation of law enforcement mechanism. The aggressive actions showed again Beijing's determination to fight air pollution. Due to harsher regulations and people's awareness of air pollution issues, APEC blue in 2014 was able to be produced. According to the Deputy director of Beijing's Environmental Bureau Fang Li, "the APEC Summit showed that the measures and technologies trajectory in clean air action plan were tested to be effective, but we still need to make the temporarily emission reduction into long term emission control plans."[123]

Under the 13th FYP, the changing of energy structure in Beijing is forming. From the heavy use of coal to gradually increasing use of natural gas, it's air pollution

[121] These acts included "Action Plans for Delineating Restricted Area for Beijing City High-Polluted Burning Fuel," "Restricted Categories for Beijing's New Industries," and "Categories for Elimination of Equipment for Beijing Cities' Industrial and Production Industries."
[122] Till the end of 2014, the total fine for every types of environmental illegal actions had exceeded 100 million RMB. The figure grew in incredible percentage annually.
[123] Ibid., 105.

problem is expected to ease especially in winter times. According to National Energy Administration (NEA) and International Gas Union (IGU), natural gas has made up to 22% of Beijing's energy structure till 2015 which is much higher than the average 6% in China and almost the same as world's average of 24%. Compared to 1994 when the total annual usage of natural gas was only 0.13 billion m^3, the annual consumption of natural gas in 2015 was over 14.6 billion m^3.[124] Beijing Gas Cooperation indicated that by year 2020 which is the end of 13th FYP, natural gas would occupy 32% of the overall energy structure in Beijing.[125] Not only can Beijing cut the heavy dependence of coal, but also decrease the air pollution degree caused by electricity producing procedure.

2008 Beijing Olympics and 2014 APEC Summit considered to be the critical juncture for Beijing's air pollution control, offering Beijing government with strong incentives and force to enhance the air pollution measures level in Beijing. Self-reinforcing effect were also shown by the citizen's inquiry about why can't the people in Beijing see blue sky and clouds clearly even when the air pollution index was

[124]Yidu Wang, "Natural Gas is now taking over coal, Blue Sky Days Increased 60%," July 1, 2016. Last accessed: https://read01.com/DxQajQ.html

[125] "Gasification of Beijing: what would be the whole consideration?" *Beijing Gas*, June 1, 2016. Last accessed: http://www.bjgas.com/news.aspx?id=5683

dramatically drop? The message indicated that the citizens in Beijing had tasted and felt the good air quality during the Olympics and were eager to keep the result. The domestic self-reinforcing effect from the citizens actually combined with popular pressure model and stimulate the change of environmental policies and action plans locally and nationally, the public demand for clean air will add to the impetus for stronger and stricter policies.[126] This self-elevated awareness and environmental criteria are the most basic and essential element for improving air pollution issue.[127]

[126] Lauri Myllyvirta, "Return of the Smog: Heavy Industry Threatens Beijing's Pollution Fight," *Green Peace Energy Desk*, December 16, 2016. Last accessed: http://energydesk.greenpeace.org/2016/12/16/return-smog-heavy-industry-threatens-beijings-pollution-fight/

[127] Si Cheng Lu, "Beijing's Environmental Topic: Post-Olympics," *Green Peace*, August 7, 2008. Last accessed: http://www.greenpeace.org/hk/news/commentaries/blog/28300/

Chapter Eight: Research Findings and Conclusion

Research Findings

We can say that in Beijing's case, the air pollution control policies followed a certain path with the defining of two critical junctures. Both 2008 Olympics and 2014 APEC Summit offered the great opportunities for China to think twice when international events were being held in its capital, Beijing. The process of cleaning Beijing's air has been programmed and implemented for several decades, much improvements were shown with the effort from government and non-governmental departments. The awareness of such environmental protection had been planted into decision makers' mind in China in recent years. With the help of internet which triggered the public awareness of their motherland, this awareness soon became a force to drive the government into its reinforcing effect. We could expect if similar international events were to be hold in Beijing in the future, Beijing government would keep this path and implemented short term policies to cut down on its major and secondary air pollutants and at the same time, figure out the possible way for long term air cleansing problem in Beijing. How to keep the results and develop more accurate policies toward air pollution problem would be the next step for Beijing and

even other polluted cities in China to consider. Some suggested the widely use of air pollutants trading system[128] while some emphasize on clarifying government responsibility and intensifying penalties would help.[129] This realm has future research potential for deeper analysis.

As we could observe from previous data, short term effects were what we see. In longer term (such as five-year-term or even longer), obvious improvements are still far to reach. Even we have confirmed that people and government had rising awareness on air pollution and other environmental issues by path dependent analysis, cleaning the air in Beijing would not be easy to achieve because of either meteorological conditions or the paradox between central and local government. The policies made by central government are overall guidance. For local government, more detailed law information needed to be discussed, legislated and implemented. Hence, if local and central officials have divergence on air pollution control perspectives, such as local officials would legislate the law which favored its citizens' livelihood or economic conditions rather than the result of environmental protection,

[128] Yu Hao, "Study on the Effects of Pollution Reduction About Emissions Trading: An Empirical Analysis Based on Provincial Panel Data," *Zhejiang Sci-Tech University*, Hangzhou, China. 2014.
[129] Legislative Affairs Commission of NPC, Full Text of Air Pollution Prevention and Control Law (Amendment Draft), 2015.

the policy effects would then be cut down.[130] Feng and Liao also pointed out challenges for China's air pollution control in the future including defects of prevention and control of motor vehicle pollution[131], lack of stipulation on the air pollutant emission trading system, outdated stipulations of the air pollutant emission permit system and unclear governmental responsibilities for prevention and control of air pollution.[132] The unclear responsibilities for the air pollution is crucial because therefore, local government and officials who favor economic development are inclined to neglect their responsibilities for protecting local air quality.[133]

Last but not the least, for theoretical usage of path dependent theory, can this theory also be implemented in other countries? The answer is ambiguous since the fundamental hypothesis of path dependent analysis indicated that different path may be taken by different countries even in the same situation.[134] But on the other hand, can other cities in China copied the path of Beijing? In 2016, G20 Summit was held in

[130] Edward Wong, "Response to A City's Smog Points to A Change in Chinese Attitude," *The New York Times*, October 24, 2013. Last accessed: http://www.nytimes.com/2013/10/25/world/asia/smoggy-days-in-harbin-prompt-quick-reaction.html

[131] The prevention and control of motor vehicle pollution doesn't consider the responsible department or supervision and coordination, also the departmental rules lack the high authority of national laws and administrative regulations. See more on Feng and Liao (2016).

[132] Lu Feng, and Wenjie Liao, "Legislation, Plans, and Policies for Prevention and Control of Air Pollution in China: Achievements, Challenges, and Improvements," *Journal of Cleaner Production* 112 (2016): 1549-1558.

[133] Qiang Zhang, Kebin He, and Hong Huo, "Policy: Cleaning China's Air," *Nature* 484 (2012): 161-162.

[134] Ruth Berins Collier, and David Collier, "Shaping the Political Arena," *Princeton University Press*, 1991.

Hangzhou. Local government gave similar air cleaning policy package to ensure the blue skies in Hangzhou.[135] If the analysis could be reproduced in other areas in China, it would be even more convincing that China's air pollution policies is following a certain path.

Conclusion

The thesis concluded that Beijing's air pollution problem has begun its transformation. From an economic-growth-oriented city to an economic-environment-coexisted city, China grasped the chance on both critical junctures to alter the original unwillingness of facing air pollution and sustainability problem. Short term efforts have been confirmed as effective and long term policies are expected to do more in the recent future. Statistics about good air quality days has been improving in recent years as more stringent policies were implemented.[136] But still, with much effort made for all the improvements, the air condition hasn't dramatically changed to give back the clear sky and air for Beijing's citizens. The reasons behind this could be "the meteorological conditions of Beijing", or "the asymmetric cognizance between

[135] Ben Westcott, "Blue Skies and Police Vans: China Prepares to Host its First G20 Summit," *CNN,* August 31, 2016. Last accessed: http://edition.cnn.com/2016/08/30/asia/china-hangzhou-g20-2016/index.html

[136] "After a Year, Air Quality in Beijing Had Been Exceeding Past Average," *Beijing Municipal Environmental Protection Bureau*, July 31, 2009. (In Chinese) http://www.bjepb.gov.cn/bjhrb/xxgk/ywdt/dqhjgl/dqhjglgzdtxx/500606/index.html

central and local government." The two parts contain huge potential for future research as mentioned before. As time goes by, Beijing proved short-term possibility for cleaning its air. The challenge lies on how the policy makers and the public coordinates to bring out the best regulations and realize them, make the good air into reality. In other words, Beijing needs to build the detailed-oriented self-reinforcing mechanism either using citizens' pressure to the government or from rewards to environmental-friendly industries. If these policies could be successfully implemented afterwards, self-reinforcing effect could bring the polices and improvements to another level.

It seems that the next critical juncture could also be set in the near future. Beijing, again, honored to be the host for 2020 Winter Olympics.[137] Till then, Beijing would be the first city which hold both Summer and Winter Olympics in the history (see Appendix 1). This time, air pollution problem will surely be magnified as well. The policies which are about to be implemented in the near future before the Winter Olympics could then be expected to be stricter than now. On the other hand, the Winter Olympics is going to be around February, the most polluted period in a year

[137] "Winter Olympics 2022 Decision: Beijing Beats Almaty to Host Games- as it Happened," *The Guardian*, July 31, 2015.

showed in previous statistics. Hence, the future Beijing Winter Olympics will definitely be the inspection for Beijing's air pollution control in recent years and provide a good opportunity for further research.

According to the Ji Ning Chen from MEP, "Our measures are correct and effective. Environmental issues cannot be solved in short term like two or three years, even some developed countries took more than fifty years," and he even indicated that, "we will surely solve the problem even before developed countries."[138] The minister also urge the public to "speak up in any form" after he watched the documentary "Under the Dome."[139] He hoped to bring out more public awareness which matched with the self-reinforcing effect. Sun also indicated the importance on public awareness of air pollution problem is one of the very key character in China's future environmental policies.[140]

Beijing, in hopes to keep its right trajectory with firm, steady pace of environmental improvement, the sky in Beijing may one day be clear and citizens

[138] Guo Meijun, "Daluzhengzhiwumai, qunianzhongwurantianqipinxian" (Heavy Smog Days Frequently Appeared Even Now China is Trying to Solve the Problem), LianHe Xinwenwang (UDN), March 3, 2017. Last accessed: https://udn.com/news/story/7332/2333238?from=udn-relatednews_ch2

[139] "Zhongguohuanbaobubuzhang: gulichaijingshiguanzhuhuanjing" (Minister of MEP: Encourage to Care More About Environment Using Chai Jing's Way), FengChuanMei, March 1, 2017. Last accessed: http://www.storm.mg/article/42767

[140] Yixian Sun, "The Changing Role of China in Global Environmental Governance," *China's Rising Role in Global Governance: Opportunities & Challenges* 1 (2016): 44.

may get away with the shadow of smog. Just as the Chinese premier, Li Keqiang's aphorism pointed out few months ago during annual political congress: "We will make our skies blue again."[141]

[141] Tom Phillips, "China's Premier Unveils Smog-Busting Plan to 'Make Skies Blue Again'," *The Guardian*, March 5, 2017. Last accessed: https://www.theguardian.com/world/2017/mar/05/china-premier-li-keqiang-unveils-smog-busting-plan-to-make-skies-blue-again-air-pollution

Bibliography

A. Corrigan, Robert. 1996. "Supercities: Environmental Quality and Sustainable Development." Atmospheric Environment 30. 679-680.

Aatmeeyata, Kaul, D.S., and Sharma, Mukesh. 2009. "Traffic Generated Non-Exhaust Particulate Emissions from Concrete Pavement: A Mass and Particle Size Study for Two-Wheelers and Small Cars." Atmospheric Environment 43. 5691-5697.

An X,. Zhu T., Wang Z., Li C., and Wang Y. 2007. "A Modeling Analysis of a Heavy Air Pollution Episode Occurred in Beijing." Atmospheric Chemistry and Physics 7. 3103-3114.

Aunan, Kristin., Berntsen, Terje K., Myhre, Gunnar., Rypdal, Kristin., Streets, David G., Woo, Junghun, and Smith, Kirk R. 2009. "Radiative Forcing from Household Fuel Burning in Asia." Atmospheric Environment 43. 5674-5681.

Baum, R. 2008. “Beijing Recoils Under the Global Spotlight.” Far Eastern Economic Review.

Bono, R., Piccioni, P., Traversi, D., Degan, R., Grosa, M., Bosello, G., Gilli, G., Arossa, W., and Bugiani, M. 2007. "Urban Air Quality and Carboxyhemoglobin Levels in a Group of Traffic Policemen." Science of the Total Environment 376. 109-115.

Byrne, J., and Shen Bo. 1996. “The Challenge of Sustainability: Balancing China’s Energy, Economic and Environmental Goals.” Energy Policy 24. 455-462.

Chan Chak K., and Yao Xiaohong. 2008. "Air Pollution in Mega Cities in China." Atmospheric Environment 42. 1-42.

Chen Yuyu, Jin Gingerzhe, Kumar Naresh, and Shi Guang. 2011. "The Promise of Beijing: Evaluating the Impact of the 2008 Olympic Games on Air Quality." National Bureau of Economic Research (NBER) Working Paper 16907.

Cindy Fan, C. 2006. “China’s Eleventh Five-Year Plan (2006-2010): From “Getting Rich First” to “Common Prosperity.” Eurasian Geography and Economics 47. 708-723.

Collier, R.B., and Collier, D. 1991. “Shaping the Political Arena.” Princeton University Press.

Congleton, Roger D. 1992. "Political Institutions and Pollution Control." The Review of Economics and Statistics 74. 412-421.

Crompton, Paul., Wu Yanrui. 2005. "Energy Consumption in China: Past Trends and Future Directions." Energy Economics 27: 195-208.

David, Paul A. 2000. "Path Dependence, its Critics and the Quest for Historical Economics." Publication: All Souls College, Oxford and Stanford University.

Economy, E. 2006. “Environmental Governance: The Emerging Economic Dimension.” Environmental Politics 15. 171-189.

Feng Lu, and Liao Wenjie. 2016. "Legislation, Plans, and Policies for Prevention and Control of Air Pollution in China: Achievements, Challenges, and Improvements." Journal of Cleaner Production 112. 1549-1558.

Gan Lin. 1998. “Energy Development and Environmental Constraints in China.” Energy Policy 26. 119-128.

Gandhi, Jennifer., and Przeworski, Adam. 2007. "Authoritarian Institutions and the Survival of Autocrats." Comparative Political Studies 40. 1279-1301.

Gourevitch, P. 1978. “The Second Image Reversed: The International Sources of Domestic Politics.” International Organization 32. 881-912.

Hall, Jane V. 1994. "Assessing Health Effects of Air Pollution." Atmospheric Environment 30. 743-746.

Hao Jiming, and Wang Litao. 2012. "Improving Urban Air Quality in China: Beijing Case Study." Journal of the Air & Waste Management Association 55. 1298-1305.

Hao Jiming, Wang Litao, Shen Minjia, Li Lin, and Hu Jingnan. 2007. "Air Quality Impacts of Power Plant Emissions in Beijing." Environmental Pollution 147. 401-408.

Hildebrandt, T., and Turner, J.L. 2009. “Green Activism? Reassessing the Role of Environmental NGOs in China.” Routledge 41.

Hrust, Lovro., Klaic, Zvjezdana Bencetic., Krizan Josip., Antonic Oleg., and Hercog Predrag. 2009. "Nerual Network Forecasting of Air Pollutants Hourly Concentrations Using Optimised Temporal Averages of Meteorological Variables and Pollutant Concentrations." Atmospheric Environment 43. 5588-5596.

Hu, Maogui, Jia, Lin, Wang, Jinfeng, and Pan, Yuepeng. 2013. “Spatial and Temporal Characteristics of Particulate Matter in Beijing, China using the Empirical Mode Decomposition Method.” Science of the Total Environment 458-460. 70-80.

Huang Kan, Zhang Xingying, and Lin Yanfen. 2015. "The APEC Blue Phenomenon: Regional Emission Control Effects Observed from Space." Atmospheric Research 164. 65-75.

Kato Nobuo. 1993. "Analysis of Structure of Energy Consumption and Dynamics of Emission of Atmospheric Species Related to the Global Environmental Change in Asia." Atmospheric Environment 30. 757-785.

Khan, M.A.H., Cooke, M.C., Utembe, S.R., Archibald, A.T., Derwent, R.G., Xiao, P., Percival, C.J., Jenkin, M.E., Morris, W.C., and Shallcross, D.E. 2015. "Global Modeling of the Nitrate Radical for Present and Pre-Industrial Scenarios." Atmospheric Research 164. 347-357.

Li Y.F., Cao S.R., Ji R.D., and Liang C.K. 1994. "Indoor and Outdoor Air Pollution in Tokyo and Beijing Supercities." Atmospheric Environment 30. 695-702.

Lin Gan. 1998. "Energy Development and Environmeental Constraints in China." Energy Policy 26: 119-128.

Liu Xuejun, Chang Yunhua, and Zhang Weifeng. 2015. "Evidence for a Historic Change Occurring in China." Environmental Science & Technology.

Madaniyazi, L., Guo, Yuming, Yu, Weiwei, and Tong, Shilu. 2015. “Projecting Future Air Pollution-Related Mortality Under a Changing Climate: Progress, Uncertainties and Research Needs.” Environment International 75. 21-32.

Ma Ning, and Liu Min. 2009. "The Impact and Durative of the Measures of Securing Quality for the Beijing Olympics and Paralympics Games 2008 on Air Pollution Index in Beijing." China Journal of Preventive Medicine 43, 517-521.

Mage, David., Ozolins, Guntis., Peterson, Peter., Webster, Anthony., Orthofer, Rudi., Vandeweerd, Veerle., and Gwynne, Michael. 1995. "Urban Air Pollution in Megacities of the World." Atmospheric Environment 30. 681-686.

Mahoney, James. 2000. "Path Dependence in Historical Sociology." Theory and Society 29. 507-548.

Matsuzawa, S. 2012. “Citizen Environmental Activism in China: Legitimacy, Alliances, and Rights-based Discourses.” ASIA Network Exchange 19. 81-91.

Mertha, A.C. 2008. “China’s Water Warriors: Citizens Action and Policy Change.” *Cornell University Press*.

Ministry of Environmental Protection of the People's Republic of China. 2015. Environmental Protection Law of the People's Republic of China.

Ministry of Environmental Protection of the People's Republic of China. 2015. Law of the People's Republic of China on Prevention and Control of Atmospheric Pollution.

Omer, A. 2008. "Energy, Environment and Sustainable Development." Renewable and Sustainable Energy Reviews 12: 2265-2300.

Price, L., Levine, M.D., Zhou Nan, Fridley, D., Aden, N., Lu Hongyou, McNeil, M., Zheng Nina, Qin Yining, and Youwargana, P. 2011. "Assessment of China's Energy-Saving and Emission-Reducion Accomplishments and Opportunities During the 11th Five Year Plan." Energy Policy 39: 2165-2178.

Putnam, Robert D. 1988. “Diplomacy and Domestic Politics: The Logic of Two-level Games.” International Organization 42. 428-459.

Schleicher, N., Norra, S., Chen, Yizhen, Chai, Fahe, and Wang, Shulan. 2012. “Efficiency of Mitigation Measures to Reduce Particulate Air Pollution- A Case Study During the Olympic Summer Games 2008 in Beijing, China.” Science of the Total Environment 427-428. 146-158.

Sun, Yele., Wang, Zifa., Wild, Oliver., Xu, Weiqi., Chen, Chen., Fu, Pingqing., Du, Wei., Zhou, Libo., Zhang, Qi., Han, Tingting., Wang, Qingqing., Pan, Xiaole., Zheng, Haitao., Li, Jie., Guo, Xiaofeng., Liu, Jianguo., and Worsnop, Douglas R. 2016. "APEC Blue: Secondary Aerosol Reductions from Emission Controls in Beijing." Publication: Scientific Reports.

Sun Yixian. 2016. “The Changing Role of China in Global Environmental Governance,” *China’s Rising Role in Global Governance: Opportunities & Challenges* 1. 43-53.

The State Council of the People's Republic of China. 10th -13th Five-Year Plan.

The State Council of the People's Republic of China. 2007-2015. China's Policies and Actions on Climate Change.

Thelen, Kathleen. 1999. "Historical Insitutionalism in Comparative Politics." Annual Review of Political Science 2: 369-404.

Tyler, Stephen R. 1994. "Household Energy Use in Asian Cities: Responding to Development Success." Atmospheric Environment 30. 809-816.

Wang Hongbo, Zhao Laijun, Xie Yujing, and Hu Qingmi. 2016 "APEC Blue- The Effects and Implications of Joint Pollution Prevention and Control Program." Science of the Total Environment 553, 429-438.

Wang Litao, Jang Carey, Zhang Yang, Wang Kai, Zhang Qiang, Streets, David., Fu Joshua, Meskhidze, Nicholas., Voorhees, Scott., Evarts, Dale., and Phillips, Sharon. 2010. "Assessment of Air Quality Benefits from National Air Pollution Control Policies in China. Part II: Evaluation of Air Quality Predictions and Air Quality Assessment." Atmospheric Environment 44. 3449-3457.

Wang Shaoguang. 2008. "Changing Models of China's Policy Agenda Setting." Modern China 34. 56-87.

Wang Shuxiao, and Hao Jiming. 2012. "Air Quality Management in China: Issues, Challenges, and Options." Journal of Environmental Sciences 24. 2-13.

Wang T., Nie W., Gao J., Xue L.K., Gao X.M., Wang X.F., Qiu J., Poon C.N., Meinardi S., Blake D., Wang S.L., Ding A.J., Chai F.H., Zhang Q.Z., and Wang W.X. 2010. "Air Quality During the 2008 Beijing Olympics: Secondary Pollutants and Regional Impact." Atmospheric Chemistry and Physics 10. 7603-7615.

Wang Ting, and Xie Shaodong. 2009. "Assessment of Traffic-Related Air Pollution in the Urban Streets Before and During the 2008 Beijing Olympic Games Traffic Control Period." Atmospheric Environment 43. 5682-5690.

Wang Zhanshan, Li Yunting, Chen Tian, Zhang Dawei, Sun Feng, Wei Qiang, Dong Xin, Sun Ruiwen, Huan Ning, and Pan Libo. 2015. "Ground-Level Ozone in Urban

Beijing Over a 1-year Period: Temporal Variations and Relationship to Atmospheric Oxidation." Atmospheric Research 164. 110-117.

Winskel, Mark. 2007. "Book Review: Energy and Culture: Perspectives on the Power to Work." Science of the Total Environment 376. 359-360.

Yang Guobin. 2009. “The Power of the Internet in China: Citizen Activism Online.” Columbia University Press.

Yang Hainan, Chen Jing, Wen Jiaojiao, Tian Hezhong, and Liu Xingang. 2016. "Composition and Sources of PM2.5 around the Heating Periods of 2013 and 2014 in Beijing: Implications for Efficient Mitigation Measures." Atmospheric Environment 124. 378-386.

Yao Runming, Li Baizhan, and Steemers, Koen. 2005. "Energy Policy and Standard for built Environment in China." Renewable Energy 30: 1973-1988.

Yuan Xueliang, and Zuo Jian. 2011. “Transition to Low Carbon Energy Policies in China- From the Five-Year Plan Perspective.” Energy Policy 39. 3855-3859.

Zhang Hefeng, Wang Shuxiao, Hao Jiming, Wang Xinming, Wang Shulan, Chai Fahe, and Li Mei. 2016. "Air Pollution and Control Action in Beijing." Journal of Cleaner Production 112. 1519-1527.

Zhang Kun-min, and Wen Zong-guo. 2008. “Review and Challenges of Policies of Environmental Protection and Sustainable Development in China.” Journal of Environmental Management 88. 1249-1261.

Zhang Minsi, Song Yu, Cai Xuhui. 2007. "A Health-Based Assessment of Particualte Air Pollution in Urban Areas of Beijing in 2000-2004." Science of the Total Environment 376. 100-108.

Zhang Wenjie, Zhuang Guoshun, Huang Kan, Li Juan, Zhang Rong, Wang Qiongzhen, Sun Yele, Fu, Joshua S., Chen Ying, Xu Dongqun, and Wang Wei. 2010.

"Mixing and Transformation of Asian Dust with Pollution in the Two Dust Storms Over the Northern China in 2006." Atmospheric Environment 44. 3394-3403.

Zhang XingPing, Cheng XiaoMei. 2009. "Energy Consumption, Carbon Emissions, and Economic Growth in China." Ecological Economics 68: 2706-2712.

Zhao Suping, Yu Ye, Yin Daiying, and he Jianjun. 2015. "Meteorological Dependence of Particle Number Concentrations in an Urban Area of Complex Terrain, Northwestern China." Atmospheric Research 164. 304-317.

Zheng Shiming, Yi hongtao, and Li Hui. 2015. "The Impacts of Provincial Energy and Environmental Policies on Air Pollution Control in China." Renewable and Sustainable Energy Reviews 49. 386-394.

Zhu Lei, Huang Xin, Shi Hui, Cai Xuhui, and Song Yu. 2011. “Transport Pathways and Potential Sources of PM10 in Beijing.” Atmospheric Environment 45. 594-604.

Zhu Yongguan, Wang Zijian, Wang Lei, Christie, Peter., and Bell, J. Nigel B. "China Steps up its efforts in Research and Development to Combat Environmental Pollution." Environmental Pollution 147. 301-302.

Internet Resource

BBC News (http://www.bbc.com/news)
Council on Foreign Relations (https://www.cfr.org)
CNN News (http://edition.cnn.com)
Greenpeace (http://www.greenpeace.org/international/en/)
MEP Website (http://english.mep.gov.cn)
NY Times (https://www.nytimes.com)
Quartz Media (https://qz.com)
Renmin Wang (http://www.people.com.cn)
Sina Wang (http://www.sina.com.cn)
The Guardian (https://www.theguardian.com/international)
UDN News (https://udn.com/news/index)

Appendix

City (by alphabet)	States	First time	Second time	Third time	Times in Total
Athens	Greece	4/6-4/15 (1896)	8/13-8/29(2004)	NA	2
Beijing	China	8/8-8/24(2008)	2/4-2/20(2022)	NA	2
Innsbruck	Austria	1/29-2/9(1964)	2/4-2/15(1976)	NA	2
Lake Placid	USA	2/4-2/15(1932)	2/14-2/24(1980)	NA	2
London	UK	4/27-10/31(1908)	7/29-8/14(1948)	7/27-8/12(2012)	3
Los Angeles	USA	7/30-8/14(1932)	7/28-8/12(1984)	NA	2
Paris	France	5/14-10/28(1900)	5/4-7/29(1924)	NA	2
St. Moritz	Switzerland	2/11-2/19(1964)	1/30-2/8(1948)	NA	2

Appendix 1: Cities that held two or more Olympics

FYP	10th	11th	12th	13th
Applicable Date	2001-2005	2006-2010	2011-2015	2016-2020
Chapter Title	Population, Resources and Environment	Building a resource-efficient, environmental-friendly society	Building a resource-efficient, environmental-friendly society	Improving the ecological environment
Sustainable Development Goal	Control population growth rate and increase forestry coverage rate, water resource usage	Conserve energy, water, soil and other materials	Conserve energy, face the global climate change	Enhance environmental quality, solve ecological problem
Main Argument	Population growth rate needs to be below 9% and increase forestry coverage rate by 18.2%, put water saving in the first place	Management of resources	Circulated economics, the ability to face natural disasters, common but differentiated responsibilities	Enhance environmental governance, build green industries, ecological protection and
Concrete Measures	Not suggested in the policy	Desulfurization of current coal-fired power plant, setting of huge wind farm as renewable energy	Flood prevention program, earthquake disaster management, scientific technologies breakthrough	Coal-to-gas program, elimination of yellow-label vehicles, setup of environmental assessment, development of green enterprises

Appendix 2: Brief from China's 10th to 13th FYP in the chapter concerning environmental and sustainable development issues