3rd International Conference

on Public Policy (ICPP3)

June 28-30, 2017 – Singapore

Panel 04

Mechanisms of Local Policy Experimentation in China

Title of the paper

The logic of local governments' actions for low-carbon pilot city: A case study of Zunyi

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Date of presentation

Friday, June 30th

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Abstract The low-carbon city pilot project is a critical policy experiment for China to seek policy instruments for low-carbon development goals. In the following paper, we explore the logic of local authorities' actions for the project of low-carbon pilot city, and the challenges between local-level experimentation and the expectations of the National Development and Reform Committee. In particular, the example of Zunyi city is studied in close detail. We compare local targets and actions with national ones, and the policy instruments chosen by the local authorities and the results they obtained for low-carbon development are illustrated as a reflection of wider problems. We argue low-carbon policy implementation currently follow an up-down implementation, with little innovation in designing additional policy instruments. Instead, we find that the Zunyi government "packages" up the low-carbon related policy instruments and results to respond the NDRC's requirement, showing less enthusiasm about the low-carbon pilot city.

Keywords policy experimentation; low-carbon pilot city; policy instrument; Zunyi

1 Introduction

China has committed to reducing carbon emissions and addressing climate change, and announced that it will reach the peak of carbon emissions around 2030. During the 12th Five-Year Plan period (from 2011 to 2015), China broke down the national targets of low-carbon development into sectoral goals and local targets. According to the "Twelfth Five-Year Plan" and the "Greenhouse Gas (GHG) Emissions Reduction Program in the 12th Five-Year Plan Period", compared with 2010, the carbon emissions per unit of GDP was scheduled to decline by 17%, the energy consumption per unit of GDP scheduled to fall by 16%, the percentage of

non-fossil energy should increase to 11.4% of the primary energy consumption, and the forest coverage of China should increase to 21.66%. In addition, it is stipulated in the "Enhanced Response to Climate Change Action: China's National Contribution", published in 2015, that China will reach the peak of carbon emissions around 2030, and the proportion of non-fossil fuels to primary energy consumption will increase to 20%. The pilot project of low-carbon pilot city is a critical policy experiment for China to seek policy instruments for low-carbon development goals, especially in the implementation of national low-carbon development plan, and reaching carbon emissions targets. Chinese-style experimentation has transformed many pilot projects into full scale operational programs, which is frequently highlighted as a potent means to facilitate institutional innovation by injecting bottom-up initiative and local knowledge into the national policy process (Heilmann, 2008). Thus, China has issued three batches of low-carbon pilot cities in 2010, 2012 and 2017 respectively. Since July 2010, the National Reform and Development Committee (NRDC) officially announced the first batch of low-carbon pilot cities, and the program has been in place for 7 years. At present, there are 81 low-carbon pilot cities, which are distributed in 31 provinces in China. In this paper, only the first and second batches of low-carbon pilot cities are studied.

Recent literature focuses on the theoretical concepts, practice, strategies and evaluation of the low-carbon cities in China. Yang and Li (2013), Liu et al. (2009) discuss the motivation and concept of the low-carbon city and the actions for building a low-carbon city. Li et al. (2012) review the practice of the low-carbon towns in China. Wang et al. (2013) summarize the general situation and main characteristics of China's low-carbon city development. Price et al. (2013), Cao and Li (2011), Liu and Qin (2016) demonstrate the contents and instruments for low-carbon development. Some scholars focus on the low-carbon development path of China or specific cities (Zhao et al., 2016; Feng and Zhang, 2012; Bi et al., 2011; Lehmann, 2013). In addition, Khanna et al. (2014) evaluates the targets, plans

and strategies being adopted by low-carbon pilot cities. Pang et al. (2016) evaluates the dynamic mechanism of the smart low-carbon city development.

The majority of literature affirms the endeavors of Chinese local governments, but some scholars argue that local pilots have not met with the NDRC's expectation(Qi, 2013; Wang et al., 2013). It raises a question that why local authorities endeavor to build low-carbon cities, while they still cannot fulfill the objectives the NDRC expected. So a further exploration for local governments' actions is needed to answer this question. Unlike previous literature on low-carbon cities in China, which focused on analyzing the practice and path for low-carbon cities, our study addresses and investigates the logic of local government's actions for the project of low-carbon pilot city. We seek to answer how local governments attempt to reach the low-carbon pilot city's targets demanded by the NDRC and why they cannot satisfy these demands. Field investigation in Zunyi and documentary analysis contribute as primary sources in addressing the research question. We argue that a bottom-up policy experimentation has become the standard of low-carbon policy implementation, with little innovation in designing additional policy instruments. Instead, we find that the Zunyi government "packages up" the low-carbon related policy instruments and results responding to the NDRC's requirements, showing less enthusiasm about the low-carbon pilot city.

The remainder of the paper proceeds as follows. In the next section, a case study of Zunyi is introduced, and a review of low-carbon targets and development of Zunyi is considered. In Section 3, the local government's actions for reaching national low-carbon targets and results of its actions are illustrated. Finally, Section 4 discusses the logic of the local government's behaviors. Section 5 summarizes our research findings.

2 Zunyi' s low-carbon targets and development

2.1 Low-carbon targets of Zunyi

Zunyi City, situated in the northern Guizhou Province, is one of the second batch of low-carbon pilot cities announced by the NDRC in 2012. By the end of 2015, the total residential population of Zunyi is 6.1921 million, with an annual GDP of CNY 216.834 billion, inreasing at a rate of 15.7% from the previous year, and its per capita GDP is CNY 35,123, 15.2% up over the previous year. To promote low-carbon development and reach the national objectives, the Development and Reform Commission of Zunyi released the "Preliminary Implementation Program of Low-carbon Pilot Work of Zunyi " in 2012 and estimated that in 2010 the amount of carbon emissions generated by fossil energy consumption totaled about 22.37 million tons, of which carbon emissions by coal consumption amounted to about 17.95 million tons, by oil consumption amounted to about 3.4 million tons, by natural gas consumption about 1.02 million tons. The proportion of carbon emissions by the above three fossil energy consumption: coal, oil, natural gas is 80.2:15.2:4.6 respectively. Carbon emissions of GDP per unit accounted for about 3.11 tons/CNY10,000 and carbon emissions intensity per capita reached 3.6 tons/person. The main sources of carbon emissions are the industrial sectors, producing more than 50% of the emissions. As can be seen in Table 1 and Figure 1, like most of low-carbon pilot cities, Zunyi submits its main targets of low-carbon development. We can find low-carbon pilot policy in China is proceeding in an orderly manner, with most of low-carbon pilot cities submitting carbon emissions peak targets earlier than the national target 2030. Compare to the national goal, Zunyi has set higher requirements for reaching carbon emissions peak in 2025. This city set forth low-carbon development goals in 2015, 2020 and 2030 respectively (See Table 2).

Table 1 The main targets of low-carbon pilot cities

Pilot Cities	**Carbon emissions peak target**	**Non-fossil fuel rate**	**Forest cover rate**
Baoding	-	2015, >5%	2020, >25%
Chongqing	-	2015, 13%; 2020, 15%	2015, 43%; 2020, 45%
Guiyang	2025	2015, 10%	1% increase per year
Hangzhou	2020	2015, 10%	2015, >65%

Nanchang	-	2015, 7%; 2020, 15%	2015, 25%; 2020, 28%
Shenzhen	Around 2020	2015,15%;2020, >15%	2015, 41.2%
Tianjin	Before 2020	2015, 2% higher than 2010	2015, 24%
Xiamen	-	-	2015, 43%
Beijing	Before 2020	2015, 6%	2015, 40%
Chizhou	2030	2015, 6.4%; 2020, 10%	2015, 57.75%; 2020, 58.85%
Daxinganling	2025	2015, 11%; 2020, 14%	2015, 81%; 2020, 81.69%
Ganzhou	2023	2015, 11.4%; 2020, 15%	2015, 76%; 2020, 76%
Guangyuan	2030	2015, >18% ; 2020, >20%	2015, >55%; 2020, 55%
Guangzhou	2020	2015, 3%; 2020, 5%	2015,42%; 2020, 42%
Guilin	Around 2030	2015, 25%; 2020, 28%	2015, 69.15%; 2020, 70.55%
Huaian	2025	2015, 6%; 2020, 16%	2015, 22%
Hulunbeier	2030	2015, 5%; 2020, 8%	2015, 52.8%; 2020, 53.2%
Jilin	2020	2015, 5%	2015, 56%
Jinchang	2020	2015, 10%; 2020, 15%	2015, 38%; 2020, 40%
Jincheng	2023	2015, 3%	2015, >44%
Jingdezhen	2023	2015, 11.4%; 2020, 15%	2015, >65%; 2020, >65.4%
Jiyuan	2020	2015, 5%	2015, 45%
Kunming	Before 2030	2015, 15%; 2020, 15%	2015, 47.65%
Nanping	2020	2015, 20%	2015, 73.54%
Ningbo	2016-2020	2015, 2.1%	2015, 50.5%
Qingdao	2020	2015, 3%; 2020, 8%	2015, >40%
Qinhuangdao	-	2015, >5%; 2020, 8%	2015, 44.5%; 2020, 46.5%
Shanghai	2020	2015, 12%	2015, 15%
Shijiazhuang	2018	2015, 5%; 2020, 7%	2015, 32%; 2020, 35%
Suzhou	2020	2015, 2%	2015, 27%
Wulumuqi	2030	2015, 13%; 2020, 15%	2015, 36%; 2020, 38%
Wenzhou	2019	2015, 12.5%	2015, 62%
Wuhan	2020	2015, 17.69%	-
Yanan	2020	2015, 8%; 2020, 12%	2015, 50%
Zhenjiang	2019	2015,12%;2020,16%	2015, >26%
◆ **Zunyi**	**2025**	**2015, 32%; 2020, 34%**	**2015, 50%; 2020, 55%**

Source: Statistical Yearbooks and Planning of each city.

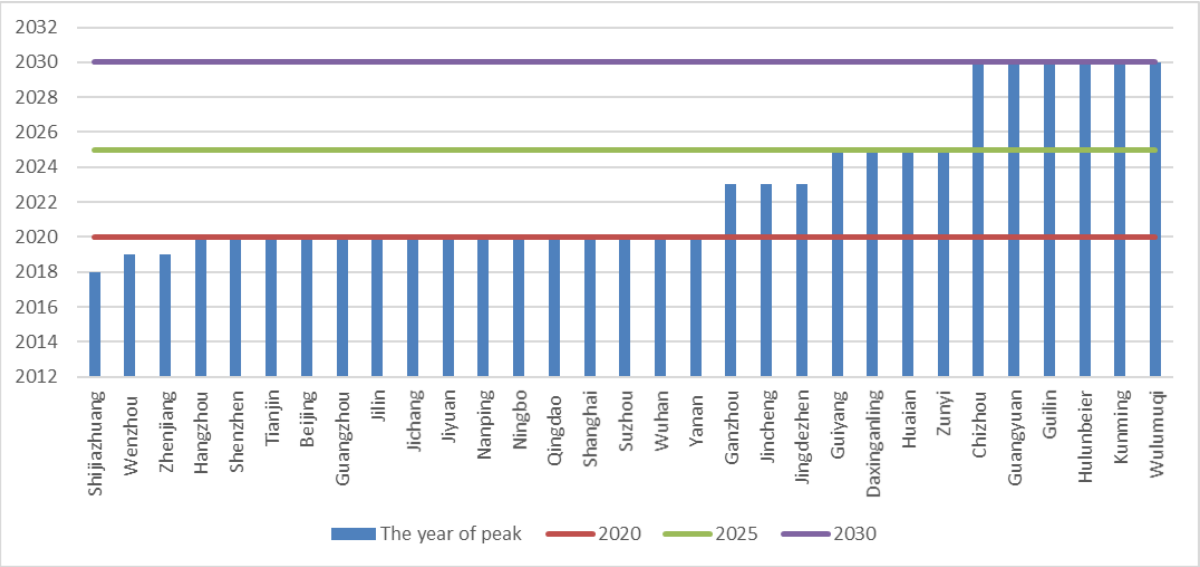

Figure 1 The carbon emissions peak target of low-carbon pilot cities

Table 2 The main low-carbon targets of China and Zunyi

Objectives	**2015 (Compare with 2010)**		**2020(Compare with 2005)**		**2030 (Compare with 2005)**	
	National target	**Zunyi's target**	**National target**	**Zunyi's target**	**National target**	**Zunyi's target**
Carbon emissions per unit of GDP	-17%	More than -22%	-40%~45%	More than -55%	60%~65%	More than -70%
Energy consumption per unit of GDP	-16%	More than -20%	/	/	/	/
Proportion of the tertiary industry	/	More than 42%	/	More than 47%	/	/
Forest coverage	21.66%	50%	/	55%	/	/
Non-fossil energy accounted for the proportion of primary energy consumption	11.4%	32%	Around 15%	34%	Around 20%	/
Carbon emissions peak target	/	/	/	/	Peak	2025

Source: policy documents from China and Zunyi.

2.2 The low-carbon development situation of Zunyi

During the 12th Five-Year Plan period, the GDP of Zunyi increased from CNY121.25 billion in 2011 to CNY218.34 billion in 2015, with an average annual growth rate of 17.9%. Meanwhile, the GDP energy consumption per unit decreased year on year, from 1.226 tons of standard coal (tsc)/CNY10,000 in 2011 to 0.922 tsc/CNY10,000 in 2015, the total reduction of 24.8% (See Figure 2).

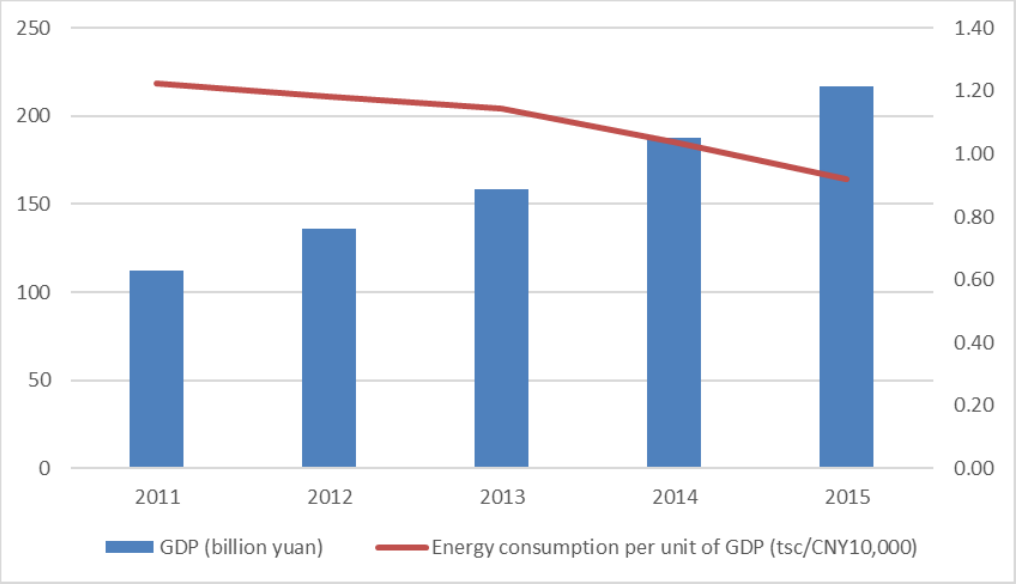

Figure 2 Zunyi's GDP and energy consumption per unit of GDP from 2011 to 2015

Figure 3 demonstrates that the low-carbon pilot cities' energy consumption per unit of GDP in 2015. The majority of pilot cities' energy consumption density is greater than the national average level (1.427 tsc/CNY10,000). Beijing is the lowest city with a level of 0.337 tsc/CNY10,000. Zunyi's energy consumption density is 0.922 tsc/CNY10,000, which is higher than the level of most pilot cities. Specifically, the energy consumption per unit of GDP is relatively low in eastern pilots, at 0.58 tsc/CNY10,000, while the levels of central and western cities are higher, at 0.86 tsc/CNY10,000 and 0.95 tsc/CNY10,000, respectively. Zunyi's index is only lower than the western average level (See figure 4). From the perspective of the decline rate of energy consumption density, low-carbon cities show greater

potential of energy saving, and Zunyi has a better rank. Figure 5 demonstrates that the decline rate of energy consumption per unit of GDP from 2011 to 2015 in most of the low-carbon pilot cities is faster than that of the national average speed (14.95%).

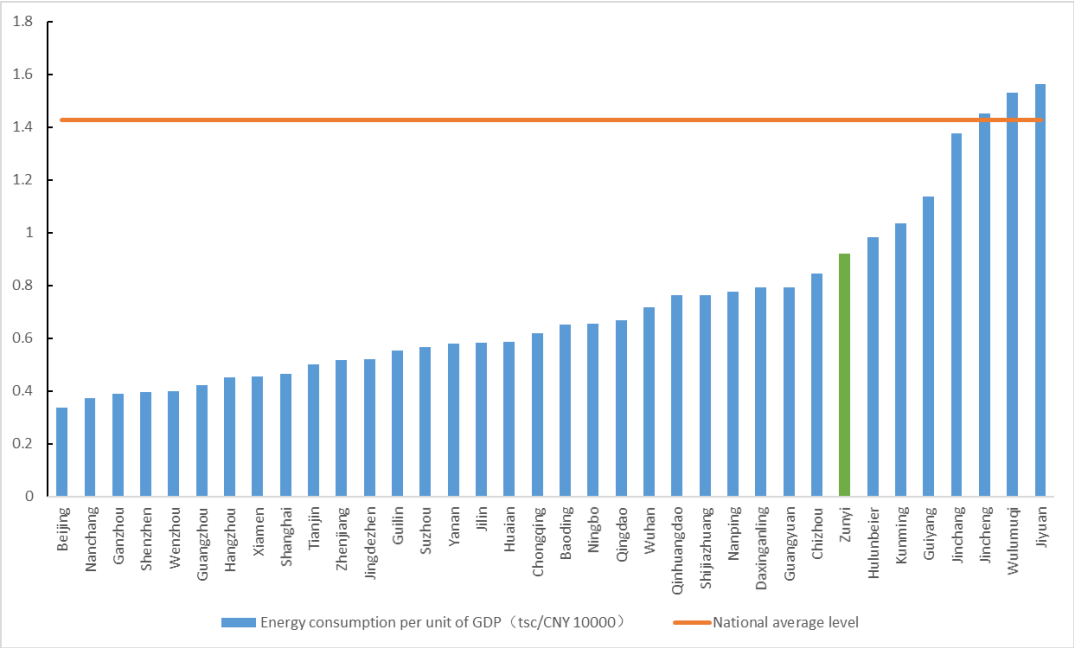

Figure 3 The energy consumption per unit of GDP in 2015

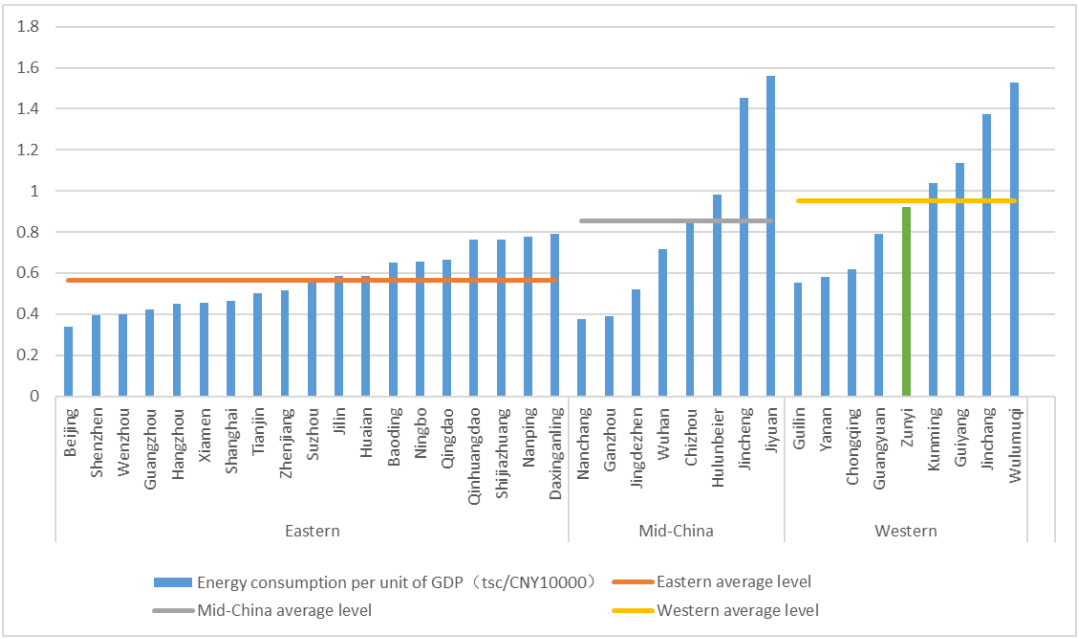

Figure 4 The energy consumption per unit of GDP in different region in 2015

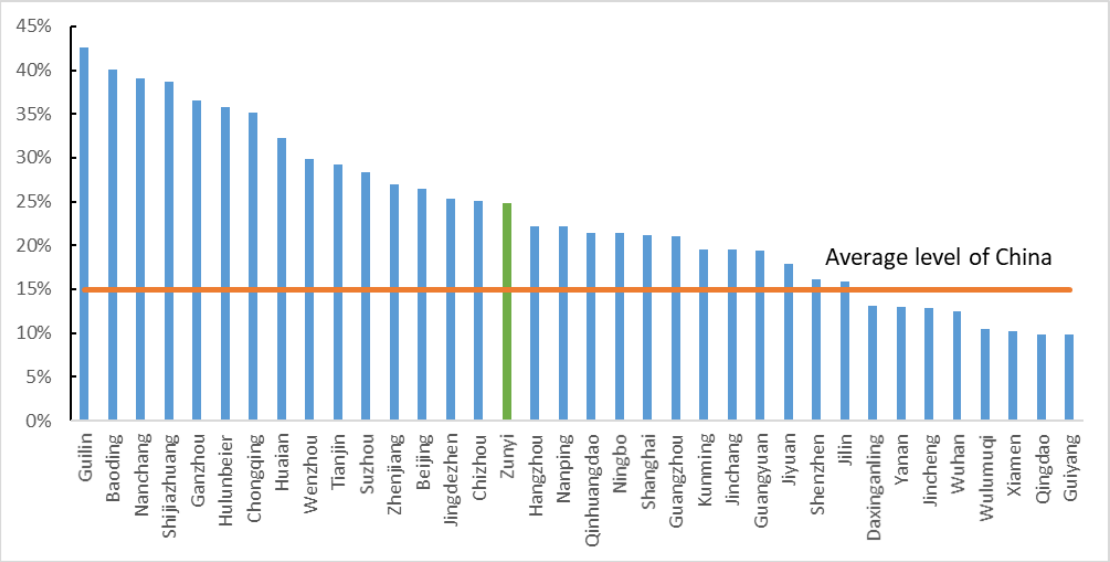

Figure 5 The decline rate of energy consumption per unit of GDP from 2011 to 2015

3 Zunyi's actions for low-carbon targets

3.1 Low-carbon production

As shown in Table 3, obligatory targets of low-carbon production, including proportions of energy consumption per unit of GDP, carbon emissions per unit of GDP and non-fossil energy consumption, have been set forth in the China's 12th Five-Year Plan. In addition, the national goals also emphasize the significance of the growth of service industries and emerging sectors of strategic importance for carbon reduction. To this end, Zunyi has advocated and implemented low-carbon production from two aspects, namely the industrial structure optimization and the energy structure optimization.

In terms of the optimization of industrial structure, Zunyi built on the natural advantages of its locality to develop light chemical industries featuring wine, tea, tobacco, medicine and specialty food through financial stimulus. Besides, relying on its history and culture, the government has seen the growth of major modern service industries such as creative industry, tourism, exhibitions industry and logistics industry. With regard to the traditional industries,

by the means of command-control policy, the local government promoted the relocation and transformation of industrial enterprises, eliminated backward production capacity, and implemented energy-saving technological transformation and cleaner production.

In terms of the energy structure optimization, Zunyi attaches greater importance of increasing hydroelectric power production through financial stimulus and increasing the use of solar energy, biomass energy and wind energy. Meanwhile, Zunyi improves the proportion of natural gas utilization and consolidates the construction of biogas digesters in rural areas, as well as the construction and management of natural gas pipeline networks in the urban area.

The industrial production process is the main source of carbon emissions. Under the dual constraints of the carbon emissions reduction and the energy saving production, the local government attaches great importance to controlling the emissions of the process. While adopting related policies, the government tends to guarantee the realization of the state goals through means of the command-control and financial stimulus. In effect, Zunyi has gained some achievements in structure optimization of industry and energy. In 2015, its energy consumption per unit of GDP is 0.922 tsc/CNY10,000, down 90.3% compared to 2010 and far more than the country's reduction target of 16%. Zunyi's development strategy of light industry has paid off with the proportion of light to heavy industry reaching a ratio of 74:26, which has completed the expected target. Meanwhile, non-fossil energy consumption of Zunyi accounts for 46%, more than the national target of 11.4%. However, in terms of the modern service industry and the emerging sectors of strategic importance, Zunyi is still in its infancy. Although the service industry and emerging sectors of strategic importance output has seen rapid growth in recent years, it has a long way to go before achieving the national goals.

Table 3 Low-carbon production

National targets	**Zunyi's actions**	**Key policy instrument choice**	**Results**

By 2015, the energy consumption per unit of GDP should be 16% lower than that of 2010; Carbon emissions per unit of GDP should be 17% lower than that of 2010.	Remove or reconstruct factories located in the old town; reduce use of outdated capacity; and employ energy-saving technology and cleaner production.	Command-control	● The energy consumption per unit of GDP has been decreased by 90.3% from 2010 to 2015. ● The total consumption of energy has increased by 7.8% from 2010 to 2015. ● The proportion of light industry output reached to 74% in 2015. ● 141 outdated production lines and 5.33 million tons of outdated capacity has been reduced during the period of 12th Five-Year Plan. ● The low-carbon pilot project of Zunyi economic and technological development zone is under construction, including green lighting, central heating and gas supply system, etc.
	Develop light industry, including wine, tea, cigarette, medicine and foods industry; and develop brand products of healthy water.	Financial stimulus	
	Promote industrial clustering and introduce low-carbon industry and enterprises.	Financial stimulus	
	Develop circular economy projects.	Financial stimulus	
By 2015, the service sector output should be increased to 47% of GDP.	Develop modern service industry, including creative industry, tourism, exhibition industry and logistics industry.	Financial stimulus	● The proportion of service industry has reached 38.7% in 2015.
By 2015, the proportion of non-fossil fuels consumption should be increased to 11.4%.	Construct more hydropower stations and biogas digesters; strengthen the development of new energies, including solar energy, biomass energy, and wind energy, and the construction of pipeline network of natural gas.	Financial stimulus	● The proportion of non-fossil fuels consumption has reached to 46% in 2015.
By 2020, the proportion of new industry output should be increased to 15% of GDP.	Develop the emerging sectors of strategic importance and high technology industry.	Financial stimulus	● The proportion of emerging sectors of strategic importance output is 4.5% of GDP, increasing by 55.2% from 2012 to 2015.

Sources compiled by the authors based on the investigation and the policy documents from the Zunyi government.

3.2 Low-carbon transport

As shown in Table 4, the national objective of low-carbon transport development is mainly reflected in two aspects: first, improving the share of public transport and non-motorized transport; second, reducing transport energy consumption. Zunyi puts forward measures including the optimization of traffic flow in the central city, the priority development of urban non-motorized and public traffic, buses that use new energy sources,

the promotion of new-energy vehicles, etc. Compared with the low-carbon production, the financial support to the low-carbon transport is limited. Therefore, the transport department of Zunyi hopes to obtain a national financial grant by receiving approval through a Green Transport Pilot City project. The financial support to a Green Transport Pilot City is much greater than that of a low-carbon pilot city. In our interview, we found that the measurements taken for the low-carbon transport by the transport department were used to build the Green Transport Pilot City. For this purpose, the department prepares hundreds of pages of application materials, and even calculates the carbon emissions of transport, which is used to meet the requirement of the declaration, rather than implementing the requirement of the low-carbon pilot city.

As a result, the project of the low-carbon transport promotion in urban areas, which receives more funding, is better implemented. In 2015, the urban area of Zunyi has witnessed the comprehensive realization of clean-energy driving vehicles, and bus trips in the city accounted for 36.6% of the motorized travel; the urban non-motorized transport has been developed, and in 2014, non-motorized vehicle lanes accounted for 52% of the urban roads; at the same time, rail transit construction entered a phase of planning and design. But in terms of transport energy consumption, Zunyi is still facing serious challenges. According to the calculation of energy consumption of transport when Zunyi was applying for the Green Transport Pilot City, the energy consumption and carbon emissions of transport in 2013 increased by 101.1% and 101.8% respectively compared to 2009. It is very difficult for Zunyi to complete the national goal of “reducing energy consumption of per traffic turnover of commercial vehicles by 10%, and carbon emissions by 11% between 2010 to 2015”. It is worth mentioning that, Zunyi has paid great attention to the manufacture and promotion of new energy vehicles, and constructed an industry park for new energy automobiles, as well as

introduced industry-renowned brands to establish the largest nesting zone for the new-energy vehicle manufacturing in the southwest China.

Table 4 Low-carbon transport

National targets	Zunyi's actions	Key policy instrument choice	Results
By 2015, the traffic energy consumption of and carbon emissions should decrease by 10% and 11% respectively, compared to that of 2005.	Initiate an application of green-traffic pilot city.	Financial stimulus	● The traffic energy consumption has increased by 101.1% and the carbon emissions have increased by 101.8% from 2009 to 2013. ● The structure of city's traffic network is being optimized.
	Renovate road network system in the midtown.	Financial stimulus	
Improve traffic conditions for walking and bicycling; increase the sharing rate of walking and bicycling.	Develop slow-traffic system and strengthen traffic infrastructures construction, including public transit hub, accommodation lane, footpath, bicycle lane, recreation trails and skyway, etc.	Command-control	● By 2014, the proportion of slow-traffic roads has been increased to 52%. ● Constructed the first ecological road nationwide.
	Construct ecotourism roads.	Financial stimulus	
Promote the public transport.	Establish a development plan and for public transport.	Command-control	● The sharing rate of public transport has increased to 36.6% by 2015. ● 13.6 km of accommodation lane has been constructed.
Speed up the application of clean-energy vehicles in public transport.	Issue a project of low-carbon traffic pilot in the midtown; employ more clean-energy buses and taxies; and construct light rails.	Financial stimulus	● All buses in the midtown have been transformed to clean-energy buses by 2015.
Encourage new energy vehicles.	Introduce well-known new energy vehicle enterprises; promote the manufacturing clustering for new-energy vehicle enterprises; issue preferential policies for new-energy vehicles; and optimize the related infrastructure.	Financial stimulus	● Construct an industrial park for new energy-vehicle enterprises and the expected output value will be around 5 billion yuan in 2016.

3.3 Low-carbon buildings

As shown in Table 5, the national goal of low-carbon buildings mainly reflects the energy-efficient requirements. In fact, the project of energy-efficient buildings is not a new

concept for the authority since it has been stipulated earlier by the Guizhou Province. In addition to building energy-efficiency constructions and transforming existing buildings, the low-carbon buildings goal also includes the promotion of green buildings, the application of energy-saving materials in buildings, and a system of energy consumption statistics. On the basis of plans for energy-efficiency buildings, the government proposes a pilot project with a special fund for the low-carbon reconstruction of Zunyi Hospital, including energy efficient lightings, central heating and recycled thermal energy in the hospital.

The policy instruments employed to facilitate low-carbon buildings include command-control, financial stimulus and voluntary means. In implementing the national mandatory standards for energy-efficient constructions and binding targets of existing energy-efficient buildings renovation, Zunyi adopts a command-control means, and strictly implements these two requirements. In terms of popularizing renewable energy architecture and renovating public buildings and rural dilapidated housings to be more energy saving, although the Zunyi government provides economic stimulus, the housing department of Zunyi still has to apply for projects funds from the national and provincial governments. This is because, unlike the project of the low-carbon renovation of the Zunyi Hospital, which is listed as a key program, most of low-carbon buildings projects do not have enough financing by the municipal-level government. In addition, Zunyi adopts a voluntary policy instrument for some unbinding targets such as the promotion of green buildings, the application of energy-saving materials, the creation of an energy-consumption statistics system, etc. With voluntary requirements, the executives tend to take no account of these tasks, resulting in poor outcomes.

Table 5 Low-carbon buildings

National targets	**Zunyi's actions**	**Key policy instrument choice**	**Results**
Proportion of energy-efficient buildings in new buildings should be increased to more than 95%.	Strictly execute the national standards.	Command-control	● All new-constructed buildings are energy-saving.

Improve energy conservation in existing buildings.	Promote energy saving renovation for existing buildings.	Command-control	● 0.35 million square meters of existing buildings are renovated in 2015, completing a provincial-level goal.
Promote energy-saving renovation for public buildings with high-energy consumption.	Improve the energy saving of new constructions, public welfare buildings, and large-scale public buildings, etc.	Financial stimulus	● The Zunyi Hospital has been renovated as a pilot.
Construct more renewable energy buildings.	Initiate the utilization and popularization of renewable energy.	Financial stimulus	● 3 projects are certified as "Renewable energy project" with special funds by provincial government during the period of the 12th Five-Year Plan.
Implement energy-saving renovation for dilapidated buildings in rural area.	Renovate the dilapidated buildings in Zunyi's rural area.	Financial stimulus	● 0.2831 million of dilapidated buildings in rural area has been renovated during 2008-2015, while another 0.1317 million of dilapidated buildings need to be renovated.
Proportion of newly constructed green buildings should be more than 20%.	Initiate more green buildings projects.	Voluntary	● 19 green buildings projects have been approved; and the proportion of green buildings is 20% in 2015.
More than 65% new materials should be used in wall materials and more than 75% new materials should be used for buildings.	Encourage to use green materials and energy-saving materials.	Voluntary	● 45 enterprises for new materials and 10 enterprises for energy-saving materials have been established during the period of the 12th Five-Year Plan.
Strengthen statistics of energy consumption, the energy audit, the energy consumption publicity, limitation of energy, price gradient of energy, and evaluation of energy efficiency.	Establish a monitor system for energy consumption of public buildings.	Voluntary	● Ongoing.

3.4 Carbon sink and waste disposal

As shown in Table 6, in terms of carbon sinks and waste disposal, although Zunyi has been a National Forest City with far higher forest coverage rate and urban green coverage ratio than the national goal, in order to meet the demands of building a National Environment Protection Model City, Zunyi adopts a stricter command-control approach to promote the reforestation and ecological protection, and employs financial stimulus to promote the control of stony desertification, returning farmland to forest and constructing forest parks. Meanwhile, the city chooses a voluntary instrument for its promoting additional forestry work.

Regarding the waste disposal, China has set two obligatory targets for the treatment rate of domestic sewage and the hazard-free treatment of domestic refuse in urban area. Thus, the government finances urban sewage treatment plants and waste disposal plants. The result shows that the sewage treatment rate of Zunyi has achieved the national target of 85%, but the garbage disposal rate is far from the goal of 90%.

Table 6 Carbon sink and waste disposal

National targets	Zunyi's actions	Key policy instrument choice	Results
By 2015, the forest coverage should be increased to 21.66%, and the green coverage in urban area should be increased to 39.5%.	Strengthen the afforestation and resources management; and establish a protection system for ecosystem.	Command-control	● The forest coverage is 55% in 2015. ● The green coverage in urban area is 39.5% in 2015.
	Strengthen the control of rocky desertification, implement a project of return farmland to forest; and construct forest parks.	Financial stimulus	
	Strengthen the propaganda of forestry protection.	Voluntary	
By 2015, the treatment rate of domestic sewage in prefecture-level city should be increased to 85%, and the hazard-free treatment of domestic refuse in urban area should be increased to 90%.	Strengthen the treatment of urban garbage; construct treating project for domestic garbage in urban area and facilities deposition for household garbage.	Financial stimulus	● 89.9% of sewage is centrally treated in 2015. ● Around 58% of domestic refuse in urban area is treated in 2015.

3.5 Low-carbon management

As shown in Table 7, low-carbon management is a unique aspect of the low-carbon policy experimentation, including the initiation of a low-carbon leading group, a plan of low-carbon actions and projects, an urban GHG emissions list, establishing an assessment system for GHG emissions and a target responsibility system for low-carbon development, and creating effective low-carbon communication, etc. For China, low-carbon management is currently in the stage of establishing regulations, thus, the country has not made binding requirements for the majority of the objectives, but hopes that pilot cities can provide experience for the low-carbon development of the country through policy innovation and

experimentation. Zunyi has adopted a command-control policy instrument aiming at necessary measures, set up a steering group of low-carbon development lead by the mayor, issued the "Preliminary Implementation Plan for Low-carbon Pilot Actions of Zunyi", "Key Low-Carbon Development Projects of Zunyi", "GHG Emissions Inventory of Zunyi", etc., and proposed to reach peak carbon emissions by 2025. At the same time, voluntary policy instruments have been adopted for non-binding targets such as establishing a target responsibility system for low-carbon development, which has seen slow progress.

Table 7 low-carbon management

National targets	**Zunyi's actions**	**Policy instruments choice**	**Results**
Establish a leading group of low-carbon pilot.	Establish a low-carbon development group led by the Zunyi's mayor.	Command-control	/
Establish and implement pilot plan for low-carbon and climate change.	Issue a plan for low-carbon developing actions and the major projects has been issued.	Command-control	● Declared the carbon emissions peak would be reached before 2025.
	Implement a low-carbon project in the Maotai Town.	Financial stimulus	
Establish a GHG emissions inventory.	Issue a GHG emissions inventory.	Command-control	/
Establish the carbon trading market.	Zunyi will take participate in the national carbon trading market before the end of 2017.	Command-control	/
Establish an assessment system for GHG emissions.	Ongoing	Voluntary	/
Establish a target responsibility system for low-carbon development.	Ongoing	Voluntary	/
Promote the low-carbon propaganda.	Construct an education and training base for low-carbon.	Financial stimulus	● An education and training base has been built in Zunyi Normal University.
	Strengthen the propaganda of low-carbon and promote citizens' low-carbon actions.	Voluntary	

Generally, the national experiment mainly makes requirements for the pilot cities from aspects like low-carbon production, low-carbon transport, low-carbon buildings, carbon sinks, waste disposal and low-carbon management. In fact, most of the targets are not exclusive for

low-carbon development, and only the carbon emissions per unit of GDP, the carbon emissions of transport, and the low-carbon management system are target requirements for low-carbon pilots. Tracing the Zunyi's actions, it has basically proposed corresponding measures aiming at the national objectives and has also achieved corresponding aims. But it is unsatisfactory for results of some key goals, for which the statement proposed by the local government remains vague. During the process of completing low-carbon indicators, the government has remained ambiguous, focusing on the completion of traditional goals such as energy-saving, pollution reduction, green transport, forest conservation, environmental protection, etc.

4 The logic of the local government's actions

4.1 The local government does not intend to implement low-carbon development, thus it simply "packages" the relevant policy instruments and results.

In approaching the low-carbon policy experimentation, the Zunyi government has not distinguished it from the tasks of energy-saving or environmental protection in how it perceives its development goals (Wang et al., 2015). Reviewing the low-carbon actions of Zunyi, the government is still executing towards traditional targets of energy-saving and pollution reduction, environmental protection, recycling economy and sustainable development. As important indicators of low-carbon development, the carbon emissions per unit of GDP and the carbon emissions of transport have not been officially announced by the government. According to the preliminary carbon emissions calculation based on energy consumption of the Zunyi's Development and Reform Committee and traffic carbon emissions provided by the transport department, it is difficult for Zunyi to reach the national goals in terms of carbon emissions per unit of GDP and traffic carbon emissions.

A similar situation is also encountered in other fields. The government only gives vague description of the progress or the unique goals for low-carbon development. In the absence of a driving force, the local authority does not have a clear understanding of the concept of low-carbon, and thus has no strong will to promote a low-carbon experimentation. Compared with targets with strong political and economic incentives, low-carbon development goals are not on the priority list of the local government. Unlike the National Environmental Protection Model City, the National Forest City or the Green Transport Pilot City, each of which can bring local governments financial resources and political incentives, the low-carbon pilot program does not bring much to local governments. Therefore, the Zunyi government does not pay sufficient attention to low-carbon development, and also does not even fully understand the idea behind low-carbon policy experimentation. Therefore, the government just mainly "packages" up the low-carbon related to those policy instruments and results, including energy-saving, forest conservation, green development, circular economy, and then submits them for approval.

4.2 Policy instruments chosen by the local government is limited, and voluntary instruments show little effect in the low-carbon experimentation.

The Chinese-style policy experimentation, "experimentation under hierarchy'', is that the central government defines the policy objectives, while subsequent policy experimentation at the local level involves a search for the appropriate policy instruments (Heilmann, 2008). The NDRC hopes localities will design new and appropriate programs or instruments to promote the low-carbon development, however, in reality the local government's choice is limited, as it tends to select the policy instruments according to the significance of national objectives, with great importance to binding goals set forth in the National Five-Year Plan, and usually achieve them with the command-control instruments. In

terms of the binding requirements from national ministries, the lower-priority goals, the government usually finances them through the Project System (PS), where big differences exist in the financial support among projects. In short, the instruments of command-control and the financial stimulus are widely used in Zunyi's low-carbon policy experimentation without adopting the market-oriented instrument. In addition, the voluntary instrument, is rarely adopted by the government, and used to only address some non-binding targets, whose importance and results is far less than those of command-control instrument and financial stimulus. On the one hand, voluntary instrument is short of sufficient incentives and constraints to be chosen, and does not enjoy any priority in face of a number of binding and capital-driven targets. The local government is too busy to deal with binding tasks with little attention to non-binding ones. Finally, the voluntary instrument suffers from a lack of clear orientation or procedure.

The process of applying for a national identification of the green buildings is complicated and time-consuming, which does not give the local governments any sound reasons for applying, although the current green buildings application is promoted by launching local green building projects. As the country has set an expected goal of 20% for the promotion of green buildings, free of strong incentives and constraints, Zunyi's official announcement of the proportion of green buildings is 20% (In fact, published green building ratio of most of the low-carbon pilot cities is also 20%). An official from the department of housing of Zunyi City said in our interview that, although actually the proportion of green buildings built in Zunyi is much higher than 20%, the desire to apply for the identification of the "green buildings" is not strong because of the complex procedure and weak incentives. The official agrees that green buildings are important for low-carbon development, and voices his inclination to convert the target of green buildings from a voluntary instrument to a command-control one. In the field of residential construction, another target executed through

the voluntary instrument is “the application proportion of new wall materials in buildings”. Since the voluntary instrument has been chosen, the priority of this target has been postponed and the head of the department in charge had no idea that this project existed. As a result, no related statistics is recorded.

4.3 The Project System widely applied restricts the sustainability of low-carbon development.

For the local authority, it is difficult to get financial support for implementing low-carbon programs, which slows down the development of low-carbon cities. Zunyi tends to use financial stimulus to guide the implementation of low-carbon programs, and only the projects listed in “Key Projects of Low-carbon Development of Zunyi” can gain funds from municipal finance. The departments of Zunyi still have to obtain financial support from the central government or the provincial government through the Project System, which in practice ends up creating internal competition for limited funds. The housing department of Zunyi needs to apply for building renovation funds from the Bureau of Housing and Construction of Guizhou Province every year. With slow and complex examination and approval process, the amount of funds is uncertain, and it is often difficult to obtain continuous support that many of reconstruction projects need. Renovating dilapidated buildings in Zunyi is a project lasting for many years. From 2008 to 2015, 283,100 households have been renovated around the city, but there are still 131,700 households remaining to be reconstructed. With the need to be assessed annually from the provincial government every year and no continuous financial support, the housing department has to divert funds from an urban demolition project to complete the target of rural dilapidated renovation.

The same is true for traffic. Transport in urban area of Zunyi has been included in a low-carbon transport project, which obtain a stable municipal financial support. However,

officials from the transformation department have to fight for more "projects" from a higher government for funding other low-carbon transport plans. Hence, the current focus of the department is to apply for a Green Traffic Pilot City to obtain more permanent financial support. Indeed, such projects intend to meet the demands of the Ministry of Transport of China (MTC) instead of the NDRC.

4.4 What should have been a bottom-up policy experimentation has become policy implementation.

In 2010, the original intention of low-carbon pilot program by the NDRC is to promote low-carbon development experimentation around the country from below through policy innovation and the piloting by local governments. The project of the low-carbon pilot city is a type of bottom-up initiative, which emphasizes that local governments should have more executive power (Qi, 2013). However, the traditional bureaucratic structure exerts pressure on the Target Responsibility System (TRS), and the piloting process has actually become the implementation of the central government's low-carbon policies. The TRS was introduced in 1991 to execute the national target of energy conservation and emissions reduction, which had created strong political motivation in the local governments (Lo, 2014). Consequently, remarkable results have been achieved as the pressure of energy-saving and emissions reduction was shouldered from the top to the bottom (Ma et al., 2011). However, in terms of the low-carbon pilot program, the central government is still at an exploring stage as the development path and a successful low-carbon model is relatively vague, thus the local government focuses on just meeting the requirements. Once leaders of the government regard this innovation as voluntary, the executive agencies see it of secondary importance. This has led to the phenomenon that local government and the executive branches have transformed the low-carbon pilot experimentation into an implementation process of different priorities,

which is reflected in the choice of policy instruments by the authority. As some scholars have noted, this type of low-carbon policy experimentation is unsuccessful for its failure to meet the requirement of the central government.

5 Conclusion

In this paper, we explore the logic of local authorities' actions for the project of low-carbon pilot city, answering the question why the local-level experimentation does not live up to the expectations of the NDRC. Using an example of Zunyi, we argue that a bottom-up policy experimentation has become low-carbon policy implementation, with little contribution to designing new and appropriate policy instruments for low-carbon development. The local government shows less enthusiasm about the low-carbon pilot city, in contrast to other pilot programs with strong economic and political incentives. Therefore, it just "packages" up the low-carbon related policy instruments and results to respond the NDRC's requirement.

Although a case of Zunyi may not reveal the general situation of low-carbon pilot cities in China, common problems exist in many low-carbon pilot cities according to an interview with an official who is from the NDRC and in charge of the low-carbon pilot program. Therefore, the NDRC demands more detailed requirements, since it has been a process of policy implementation, for the third batch of low-carbon pilots launched in 2017. Future research could investigate the actions of the third wave of pilots, examine the effects of their actions, and compare them with the previous ones.

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