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## EFFECTIVENESS OF LOW-CARBON GOVERNANCE IMPLEMENTATION IN CHINA

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### Abstract

The Chinese government has established ambitious low-carbon targets and various low-carbon development strategies in recent years, showing a strong will for low-carbon governance. However, these strategies can only take effect by transferring into strong actions in practice. This paper, therefore, reviewed the effectiveness of these policies towards low-carbon economy at the governmental, organizational and personal levels. Literature, interview and internet surveys are adopted in the investigation on three dimensions: the change behavior of industry and customer, education system, and the role of local government. The result shows that the practice of the national strategies in low-carbon governance in China lacks effectiveness and strong enforcement. The suggestions to improve low-carbon governance of China are provided, including establishing a long-term performance evaluation system for local governors, incentives for education system to involve low-carbon and sustainable development, strengthening industry standard, and promoting waste recycling.

*Key words:* carbon policy, low-carbon economy, low-carbon governance

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### 1. Introduction

Low-carbon economy aims to adjust energy structure, reduce energy consumptions, in order to reach an economic state of win-win between economic and social development and environmental protection (Qu, 2011). The economy of China has experienced the fastest growth during the last two decades. However, there were also serious environmental damage occurred in China, which may affect the future generations in satisfying their needs (Wang and Chang, 2014a; Zhou et al., 2017). As the climate change issue drew attention worldwide, it was acknowledged that sustainable growth is not an option any more, it is a necessity (WE Council, 2010). The energy consumption in China almost doubled in just 8 years between 2000 and 2008 (NBS of China, 2009). It has the largest scale of manufacture in the world,

which includes mostly energy-intensive industry. Although the carbon emission per capital in China is still low, the energy consumption has an escalating trend in the future.

In recent years, not only the developed countries but also the developing countries have been required to take more responsibility in carbon emission reduction. Being the biggest developing country, the Chinese government will place economic development at the first priority. The challenge for the Chinese government is how to balance economic growth and low-carbon development. Good low-carbon governance requires the strategy to be made for long-term sustainable economy development of a nation, and to stimulate the contribution of the whole society at the governmental, organizational and personal levels towards low carbon development (Wang and Chang, 2014b). Low-carbon policies

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perform as the instruments for the government to guide and regulate activities in different dimensions of the nation. Although the Chinese government has set up low-carbon targets and adopted relevant policies in recent years, the effectiveness of the policies reflected on the three levels of society remain need further investigation.

## **2. Literature review**

There is a huge potential for China to reduce energy intensity and carbon emission (Xu et al., 2013; Wang and Chang, 2014a). Xu et al., (2013) modeled the energy intensity along with the economic development in China, and claimed that the energy intensity in China could be reduced by over 40% (Xu, et al., 2013). Many researchers offered suggestions on policy making in low-carbon development in China. Jiang et al., (2010) reviewed the energy development strategy under low-carbon economy, and suggested the government to adopt clean energy establish related law, statutes, management institutions and mechanisms, enhance public awareness. Chen et al., (2005) studied the cost of mitigating carbon emissions in China by using Markal-macro model and suggested China should play an active role in the international carbon mitigation cooperation mechanism instead of accepting a carbon emission ceiling. Kahrl and Roland-Holst (2009) examined the growth and structural change in energy and economy sectors of China over the last decade. Their research recommended that the incipient structural changes in energy economy and sustained economic and energy demand would bring huge challenges to policy makers in China. Wang and Chang (2014b) presented a framework for low-carbon governance in three levels: strategy, methodology and operation, and they claimed the government, organization, and the general public should all play a role in carbon mitigation in order to develop a low-carbon economy in the long-term. Zhou et al., (2010) provided evaluation of the previous energy policies in China such as new laws, regulations, and programs, and to identify issues that have impact on the energy and economic aspects in China in the future. Yang et al., (2012) analyzed the factors affecting the carbon emission and its relation with Gross Domestic Product (GDP) growth in Inner Mongolia, China. They presented a pathway to low carbon economy, including developing renewable energy and coal derived clean fuel, developing emission exchange market base, tapping carbon sink potential, and education.

The impacts of low-carbon governance can be reflected from several areas. For example, the local governments were the key to implementing the national strategies set up by the central government (Luchsinger, 2010). They play an important role in guiding local business and other practitioners to achieve low-carbon target.

As developing countries rely heavily on energy-intensive industries to increase export and economy, the industrial sectors are the main

contributors for carbon emission (Huang et al., 2010). The industrial organizations play an important role in implementing government regulations and standards (Wang et al., 2014). The government strategies towards energy saving, and industrial standards of the key industries in China have significant impact on manufacture and customer behavior.

Sustainability and energy efficiency have drawn the attention of the education sector worldwide. The university education is an important way to address long-term low-carbon development in practice, as it equips future industrial professionals to practice low-carbon principles at the operational level (Wang et al., 2014). The study of Andevski et al. (2012) in Serbia showed that environmental, sustainable education forms a new way and style of life with relationships organized among people in and out of schools in the local community. They concluded that the ecology and ecological engineering principles should be implemented through sustainable environmental education. In addition, media campaign is another way to educate the general public.

Recently, the Chinese government has established low-carbon targets, which showed the strong will to reduce carbon emission. New policies were adopted to target environmental change, such as development plans, legislation, industry standards, and tax and finance policies (Zhou et al., 2010; Wang and Chang, 2014a). The previous researches provided various suggestions on policy and pathway design for China. However, there is a lack of investigation on the effectiveness of the low-carbon policies in China.

This exploratory research intends to review the effectiveness of the low-carbon development strategies in China and to generate suggestions for establishing of low-carbon governance in China. Unlike most of the previous research focusing on policy design and decision-making, this research investigates the post-policy stage by reviewing the effectiveness of low-carbon polices reflected at the governmental, organizational and personal levels.

## **3. Research methodologies**

The data triangulation method, as this method can better substantiate constructs and propositions (Jick, 1979; Eisenhardt, 1989). Therefore it was adopted in this research for data collection. The data came from three sources, including literature and document reviews, internet surveys and interview surveys. The literature and document review methods address the quantitative data collection. The interview survey method performs as supplementary for qualitative data when quantitative data are not available.

On the basis of literature review and interview survey, the research defined main aspects to assess the impacts of China's low-carbon governance in practice, which are 1) local government, 2) industrial and costumer behavior change, 3) education. The local governments are the implementer of national strategies due to the top-down hierarchical governance

structure. The industry is the largest carbon emitter in China, and customer behavior change could accelerate the elimination of high-carbon production and living styles. Therefore their behavior change significantly affects the process of low-carbon development in China. The education system is responsible to equip youngsters with professional competence and skills, who will become the main practitioners in various sectors of the society. The involvement of low-carbon in education has an important influence on the future development pattern of China. In this paper, the review of the low-carbon strategies in China was discussed in the three main aspects.

There were 136 official websites, in which 2/3 of the websites were from China, were browsed during the research in order to collect quantitative data for analysis. In some cases, comparison was made between China and other developed countries. Three internet surveys were used to investigate the opinion of the general public. There were 4,987 responds collected through internet surveys.

The questions in semi-structured interview survey were developed from literature and document review, which focused on the general background to the low-carbon governance in China and effectiveness on operation of local government, industry and society in practice. Examples of questions asked in the interview survey are “What low-carbon targets have been made in your sector? What were the obstacles to fulfill these goals?”, “What were the subsequent policies or tools adopted and how were these implemented in practices?”, “What were the behavior changes towards low-carbon development in your sector?”, “What were the impacts of the government policies on your sector/behavior?”

The investigation target groups in this research include the authorities, industries and societies. A total number of 12 relevant practitioners and experts participated in the interview surveys, which are from industry sector (5), government official (3) and research and education sector (4). Each interview lasted between 30 to 60 minutes. The interviews were recorded with the permission of the interviewees and then transcript by researchers. The qualitative data collected through interview survey were then analyzed by using content analysis method.

#### **4. Effectiveness of low-carbon governance in China**

##### *4.1. The Role of Local Government*

The interview survey with government officers revealed that the low-carbon target was assigned from top down by a hierarchical structure. The national strategies of the central government were first interpreted by the related government departments, and then authorized by the provincial governments who then transferred policies and regulations to sub-levels below. For example, the carbon reduction target was distributed to the local governments from the central government to the smallest units in the governmental structure. The local authorities issued

regional regulations and industry standards accordingly. However, the key problem in practice is the reluctance of the local governments to accept higher carbon target as they fear the corresponding impacts on the economic growth of the locality.

Unlike in the United Kingdom (UK) where the carbon reduction target was distributed to the government departments who could best control the development plan and upgrade regulations of each industry sector. The targets and strategies in China were transferred from the top central government to lower level local governments progressively until the bottom level. Given the large size of China, the top-down distribution method may be the best way to assign the carbon reduction target at present. The complex organizational structure of the Chinese government can cause inconsistency in regional regulations and standards. For example, some cities may adopt stricter low-carbon standards than others. As the local governors are in charge of the financing and direct administration of the local economy, the decision-making at the local government level is crucial for execution of low-carbon economy. The Notice on Work Arrangement for Energy Conservation and Pollution Reduction in 2008 issued by the State Council strengthened the accountability systems for the departments and regions on energy efficiency performance. However, there was a lack of a clear definition and accountability for the local government in regards to regional low-carbon development (Li, 2010). Although there has been an increasing number of financial assistant from the central government on low-carbon technologies and pilot projects, there was very limited funding coming from the local governments across the country.

The various pilot programs mentioned above, such as low-carbon cities and provinces, the photovoltaic pilot building program, and the waste recycling program were allocated to the local government along with financial support from the central government. However, the government has yet clearly quantified the criteria for low-carbon city and province (Price et al., 2013). The effectiveness of these programs also became an assessment criterion for the local governors; as a result the programs were paid more attention by the local government. The annual performance indexes of all the provincial governments have been published every year by the National Bureau of Statistics and the National Bureau of Energy since 2007. The results of those government funded projects and programs turned out to be fairly successful. During the 11th five-year plan, 179 major projects for comprehensive utilization of resources were supported by the central government, which reused 34.5 million tons of industrial solid waste, recycled 1.7 millions of metals and conserved 3.7 million cubic meters of wood resources.

In order to improve the waste recycling performance of the nationwide industry and society in China, further actions should be taken to extend the successful experience of the pilot projects. The effectiveness of the local governments in regional

low-carbon development should be included in the performance evaluation of the local governments in addition to the pilot projects and programs; otherwise the regional carbon reduction would always be given lower priority in comparison to economic development (Wang and Chang, 2014a). The current political incentive system for local governors based on local GDP is a critical constraint for the low-carbon development of local economy (Qi, 2012). The lack of carbon audit system, which acts as the organization to supervise the local government behavior, is another obstacle to the implementation of low-carbon governance.

It was revealed through interview survey that the typical term of office of the local governors in China is four to five years. However, it usually takes a longer period for the effectiveness of low-carbon initiatives to be shown. Most of the local governors lacked interests to adopt a long-term policy for carbon reduction (Luchsinger, 2010). There is a lack of an effective performance assessment system for the local government in regards to low-carbon economic development especially in a long-term view. The inadequate coordination and monitoring mechanism, and bureaucracy in the multi-hierarchical government structure are the key problems, when the low-carbon policies passing down from the central government to local levels. Incentives are required in order to encourage the local government to take responsibilities in financial aid, tax relief, government procurement, supervision and propaganda for low-carbon development.

#### 4.2. Industry and customer behavior change

The result from interview survey showed the Chinese government has adopted a large number of low-carbon policies to target various industries, such as energy-intensive heavy industry, manufacture, tertiary industry, renewable energy industry, forest industry. The objectives of the recent policies are 1) energy conservation, 2) promoting tertiary industry, 3) renewable energy development, 4) reforestry, and 5) circular economy.

The strategies of the Chinese government towards low-carbon governance have large impacts on the behavior of the industry and costumers. For example, the industry structure is gradually moving away from manufactory industry. The contribution of the service industry to GDP increased from 40 to 43% between 2005 and 2010, with an annual growth of 11.9% in added value (NDRC, 2011). The energy-intensive industry had to adopt new technologies to cope with the government's requirements on energy conservation. Between 2006 and 2010, there were totally 77 million kW capacity of low-efficient coal-fired power plants were shut down between year 2006 and 2010. Some backward facilities were forced to close, which accounted for 7.2 million tons capacity of steel production, 120 million tons of iron production, and 370 million of cement production. In the interview survey the directors in large state scaled enterprises

said they have adopted environmental management system. They believed the environmental certificate such as ISO 14001 helped them to establish environmental management system, which would benefit them from improvements in market competitiveness and reputation.

The renewable industry received large direct financial support since the announcement of the 2001-2015 Outline of the Development of New and Renewable Energy in 2000. For example, until 2011 the government subsidized 290 million Ren Min Bi (RMB) on the wind power industry, 13.9 billion RMB on solar power industry (GOV, 2013). The renewable industry received enormous growth following incentive policies of the government. For example, the wind turbine capacity increase more than ten times from 502 Mega Watt (MW) in 2005 to 6,400 MW in 2008; while the annual production of silicon cells increased nearly 18 times from 138 Mega Watt peak (MWp) in 2005 to 2,455 MWp in 2008. The renewable energy contributed to 8.7% of the whole energy production in China in 2010, whilst the figure in the UK was 5.3% (The Department of Energy and Climate Change, 2011). The renewable energy production in China increased sharply since year 1999 as shown in Fig. 1.

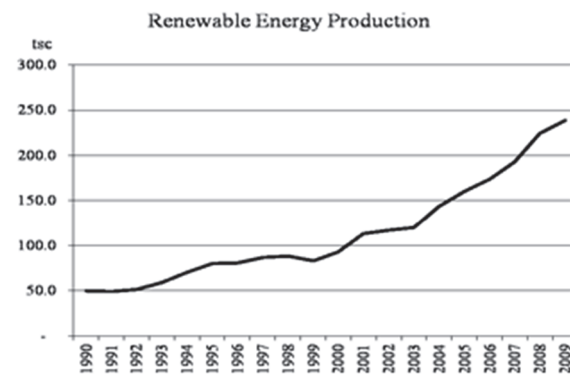


Fig. 1. Renewable energy production in China 1990-2011

However, the fast growing of renewable industry is facing the problems of electricity transmission and lack of standardization for the industry. The development of grid infrastructure for renewable energies was relatively backward. On the one hand the manufacture of renewable energy facilities grown rapidly under the financial support from the government; on the other hand, the facilities could not be fully transfer into operation due to the lack of steady on-grid system and pricing mechanism. The renewable energy industry is currently unbalanced and facing serious problem of excess production capacity.

During the interview survey, a director from renewable energy sector claimed that the direct financial aids from the government saved many enterprises which were on the verge of collapse due to low competitiveness. The competitive advantages of leading companies were substantially reduced under the policy disturbing on the market order. This

viewpoint was endorsed by another entrepreneur, who said the government should respect the rule of “survival of the fittest” in renewable market competition. An energy expert pointed out that China’s market economy was still under developing, the government yet to learn how to rely on the regulating function of the market rather than interference in market competition. In addition, since China has entered the World Trade Organization (WTO), the direct financial support to the renewable industry in China also harmed its competition in the global market. Most recently, the United States (US) and European Union (EU) have imposed anti-dumping tariffs on the solar panels from China. The government should learn to regulate market behavior and adopt tax incentives instead of direct financial aids to certain industry sectors.

The Chinese government encouraged the development of circular economy, which has been included in the recent 11th and 12th five-year development plans. In 2008 alone, there were 72 million tons of steel, non-ferrous metals, and 16 million tons of plastic were recycled (NDRC, 2009). However, it must be pointed out that a part of the recovered materials were imported from other countries. The overall imports of recovered solid wastes in 2009 were 54 million tons (Raplas, 2011). A report from the Waste and Resource Action Program (WRAP) showed that China imported 27.5 million tons of recovered paper from the UK alone in 2009 (WRAP, 2010). The overall plastic recycling in 2010 was 20 million tones, among which 8.6 million was from imported recovered plastic (Raplas, 2011).

The waste recycling has not been paid enough attention by the industry and costumers. During the interview survey, the interviewees said “it is hard to find waste recycling and sorting facilities ...” and “...there is a lack of instructions on how to sort and recycle domestic wastes...” One expert commented that “The industry should receive tougher restrictions, but there are no compulsory regulations for large waste producers such as manufacture and construction industries.” Due to the lack of regulation and instruction, the behavior of the industry and customers were not satisfactory.

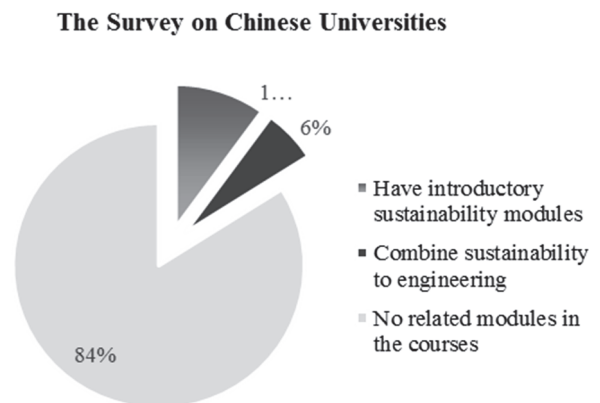
Under the reforestry policy in China, the forest developed rapidly in recent year. The forest coverage rate increased from 18.2% to 20.4% during the term 2005 to 2010. The forest area by plantation in China is about 1.96 billion hectares, the largest in the world. Under the encouragement of the government, the non-government organized voluntary tree-planting by normal citizens became a popular program in China, whilst the urban greening action was welcomed by most of the cities in China. The green coverage rate in urban areas in China was around 38.6% in 2011 (NBS of China, 2012). During the interview survey, all interviewees understood the importance of forest development and were aware of the reforestry policy of the government. However, there were still more than half of them acknowledged the contribution of reforestry on low-carbon development.

The government also required the fast growing household appliance industry to improve the energy efficiency of their products. In 2010, the market share of high-efficiency air conditioners accounted for 70%, the high-efficiency illumination products 67% (NDRC, 2011). In the interview survey, most of the interviewees said they would evaluate green label criterion over price when they choose electrical appliance products.

#### 4.3. Education

Interviews and internet combined surveys were carried out to investigate the involvement of low-carbon or sustainability related modules in the building related courses in China and the UK. The top 32 universities in China ranked by academic assessment bodies, such as the Assessment Report of Chinese Universities, the Kaoyan Forum and the Assessment Report of Chinese University League, were selected in the survey. The sample was selected from the top ranked building-related courses in the country, including; Architecture, Urban Planning, Civil Engineering, Water Supply and Drainage Engineering, Built Environment and Equipment Engineering and Engineering Management. The total number of courses in the survey was 109, which were divided into three categories: architecture, engineering-related (such as Civil Engineering, Architecture Engineering, Civil and Structure Engineering), construction-related (such as construction management, project management).

The result showed that only 10% courses (17 courses out of the 109) include sustainability-related modules in their undergraduate courses; and only 6% courses include combined sustainability development and engineering as shown in Fig. 2.

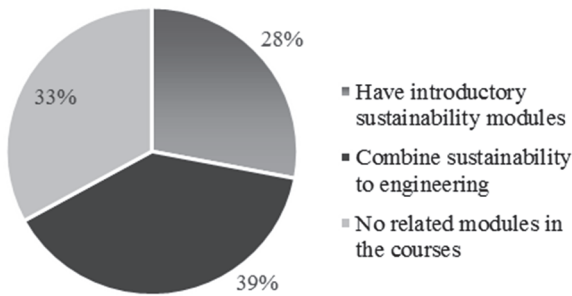


**Fig. 2.** The survey result on sustainable engineering courses in China

A similar survey was carried out to review the involvement of sustainability in the building-related courses in the top universities of the UK. The top 20 universities in civil engineering and architecture were selected as the sample for the universities according to The Times Online 2010, Good University Guide and the Guardian University Guide. In all 54 courses

across the three categories, about half the courses in the survey contained sustainability-related modules. Two thirds of the engineering-related courses have sustainability-related modules, in which 17 out of 31 contain combined engineering and sustainability modules. This accounts for more than half of the courses in the sample, as shown in Fig. 3. Almost all the management-related courses (8 out of 9) include introductory sustainability modules in their undergraduate courses, which is a huge difference when compared to the Chinese universities.

**The Survey on UK Universities**



**Fig. 3.** Survey result on sustainable engineering courses in the UK

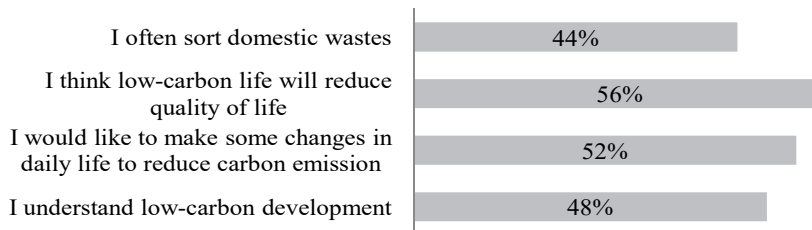
The results of the internet survey are compared in Table 1 below. The surveys showed that the education system in China lacks an incentive to integrate low-carbon development and sustainability in their standard teaching courses. Students in building related courses at the top universities in China have not been equipped with enough exposure to low-carbon development knowledge before they join the job market.

**Table 1.** The involvement of sustainability in university courses - comparison between China and UK

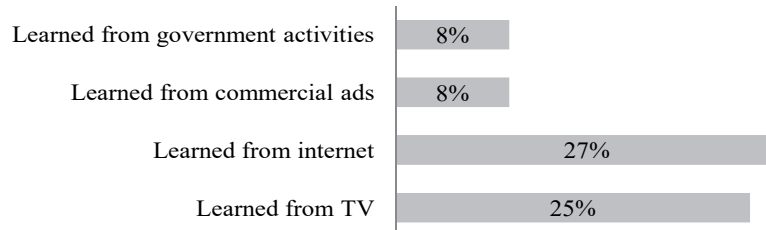
<i>Title</i>	<i>China</i>	<i>UK</i>
Number of Universities	32	20
Number of Specialties	109	54
Introductory courses	11	21
Combine Sustainability to Engineering	6	18
Total courses	17	39
Number of Engineering Specialty Related to Buildings	54	31
Combine Sustainability to Engineering	6	21

The objective of the surveys is to investigate the understanding of the general public on low-carbon development and low-carbon economy. The survey result is shown in Fig. 4 below.

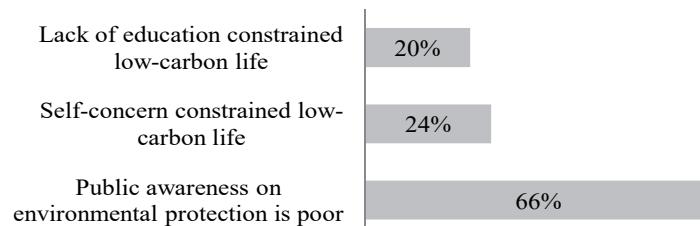
**Personal opinion on low-carbon life**



**Informatoin source**



**Evaluation of public involvement**





**Fig. 4.** Low-carbon life internet survey result from 5000 participants

In order to find explanations to this issue, this research interviewed some experts in the education sector in China. They claimed the centrally-controlled university system was less flexible than the western universities. Due to the multiple hierarchical structures of the educational system and the lengthy application and strict approval process, the course variations of the national universities took longer period than the universities in the UK. For example the major course amendment was only allowed to be made every five years, which significantly reduced the flexibility of the courses.

Although the government encouraged the media and other means to enhance the public awareness of low-carbon development, the low public awareness of low-carbon development is still a problem in China. The education and information dissemination in China regarding low-carbon development did not achieve the role in persuading people of the advantage of energy saving and emission cut, and the most effective and acceptable ways to make changes (UNDP, 2010). The case study of Wang et al., (2010) showed that the industrial practitioners would consider low-carbon options, once they understood the long-term social and economic benefits of the options to their business. The key question is whether the media gave away enough correct knowledge to the public.

In order to understand how sustainability and low-carbon were understood by the general public in China, this research referred to three internet questionnaire surveys about low-carbon development. They were the LCEL (2013), the LCLS (2012) and the LCL (2013), which were open to the general public in China.

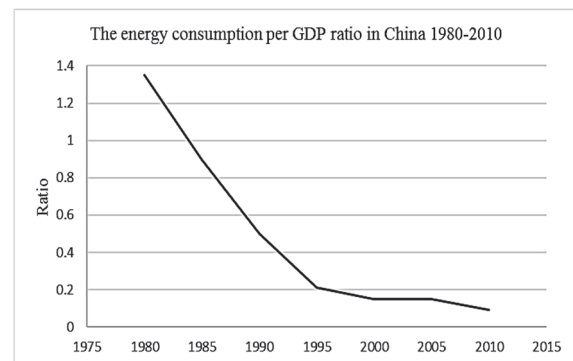
According to the surveys, about half (48% and 52% respectively) of the 5,000 participants thought they understood the meaning of low-carbon development and would like to make some changes in daily life to reduce carbon emission. The main sources they learn about low-carbon development were from TV (25%), internet (27%) and commercial advertisements (8%), while only 8% from promotional activities of the local governments. In one survey, 24% of the participants of the participants thought low-carbon life would reduce the quality of their daily lives, whilst in the other survey the number was 56%. Only around 44% of the participants often sort their domestic wastes. Self-concern (24%) and lack of education (20%) were among the main reasons why people do not participate in low-carbon life. The majority of the participants (66%) agreed the public awareness on environmental protection was poor. The result showed the misunderstood of low-carbon life prevent the general public to choose low-carbon life style. The education on low-carbon development by means of universities, media and the government needs to be strengthened in order to improve acceptance and participate of society.

The situation for primary and secondary school education in China is even more worrying. The internet survey of the curriculums of 30 schools in seven major cities showed that there is a lack of official module particularly addressing issues regarding low-carbon and sustainable development. The interview with educators discovered that all the courses must be in line with the guideline of the national educational authority. Some schools would invite visiting speakers to give speeches, where the topics were decided by the speakers. Therefore students seldom had the opportunity access to the knowledge related to these issues, unless the speakers intended to introduce this kind of knowledge.

## 5. Discussions

The Chinese government implemented low-carbon development policies and established rigorous carbon reduction targets. Development of new energy and renewable energies occupied full attention from almost all government departments. China has become the number one investor in the world on new and renewable energies.

The energy consumption in the unit of million tons of standard coal equivalents (SCE) to GDP (billion RMB) is shown in Fig. 5, which showed a steady fall since 1995. The decline rate of this ratio even reached 12% in year 2007 and 2008.

**Fig. 5.** Energy consumption (million tons of SCE) divided by GDP (billion RMB)

The research institutes benefited from the government research funds targeting low-carbon technologies. However the course development in the Chinese universities were found slower than the universities in the UK in terms of integrating low-carbon development and sustainability material and knowledge into a wide range of professional courses. In addition, it is necessary to enhance the education on general knowledge of low-carbon life to the society, in order to increase the public awareness of low-carbon development.

Due to well established monitoring and performance assessment mechanism for pilot projects and programs, the local governments played an important role in the success of pilot projects and

programs. However, the long-term performance evaluation criteria should be under the consideration of the government, and therefore the sustainability and wider social and industrial impacts of them remain to be seen in the forthcoming future.

Furthermore, waste landfill is also a major source of greenhouse gas emissions in China, and further more efforts should be made in this field. Sun and Li's (2011) survey showed that around 85% urban wastes went to landfill, which is still the key means for waste disposal. Regulations are required to control the quantity of landfill and encourage the implement of new technologies for waste assorting and disposal. Previous research also pointed out that there was currently a lack of landfill reduction target in low-carbon development strategies in China (Wang and Chang, 2014b). In addition, the landfill reduction targets should be included in the performance assessment criteria for the local governors.

## 6. Conclusions

This research reviewed the operational effectiveness of low-carbon governance in China at the governmental, organizational and personal level. In order to establish a low-carbon economy, the Chinese government issued various policies to guide the nation at the governmental, organizational and personal levels. There are, however, opportunities for improvement according to the review of the impact of low-carbon governance on the local government, industry and customer, and education sectors. Some suggestions for establishing good low-carbon governance in China are provided below:

1) The central government should establish new incentives and a long-term performance evaluation system for the local governors to transfer their focus from currently short-term economic goals to a sustainable development of a low-carbon economy. For instance, introducing the whole life costing assessment and the environmental impact assessment for decision-making in local economic development.

2) Capacity building activities should be conducted in wider scales of the education, such as training of local governors and professionals, school education, guidance giving to the general public as it is the way to plant low-carbon awareness for high level professionals and society in order to build a sustainable future for China. The education system needs more incentives to include general knowledge on low-carbon and sustainability issues.

3) New measures need to be introduced in order to measure the results and effects of the implementation of the industrial standards in real projects. The evaluation methods such as the environmental management system, green production and carbon audit can potentially improve the industrial behavior towards low-carbon development.

4) Waste management has not been paid adequate attention by the local government and the industry. Law enforcement and establishment of

stricter regulation are good means to force industry sectors to seriously cope with the huge amount of wastes derived from their production each year. The government should adopt more incentive policies towards waste sorting and recycling industry, in order to reduce landfills and increase resources recovery.

This research is not exhaustive in nature. More in-depth study such as structured interview with more government officials would be necessary in order to study the underline low-carbon governance issues in China. Future research should expand the scope of interview survey for a deeper understanding of the nature of each issue revealed in this research.

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