


# Guangyuan's Low Carbon Re-construction

Guangyuan City, China 

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Guangyuan City, a less developed city in southeast China, suffered great loss in the 2008 Wenchuan Earthquake. In the re-construction period, the city has set up the "low carbon re-construction and development" goal and generally found a good way towards sustainable city development [1]. Its experience with low carbon development is especially precious for other under-developed areas.

### Country/City Profile

	Country	City
	Population (2014)	1.364 billion [2]
	Land area (km <sup>2</sup> )	9.6 million [2]
	GDP per capita (2014, international \$, at purchasing power parity)	13,216 [5]
	Region	Asia
		Population (2014) 1.013 million (city)[3] 2.575 million (total)[3]
		Land area (km <sup>2</sup> ) 16,314 [4]
		GDP per capita / GDP per capita at purchasing power parity n/a
		Region Inland
City's physical geography	Location	<ul style="list-style-type: none"> <li>✓ Its longitude lies between 104°36' -106°45' E, and latitude between 31°31' -32°56' N.</li> <li>✓ It is located at the point of convergence for the Micang Mountains, the Longmen Mountains and the low mountainous area in northern Sichuan Basin. To the north, the area is mountainous, while the south is hilly with lower altitudes.</li> <li>✓ The highest mountain peak has an elevation of 3,837 m.</li> </ul>
	Climate	<ul style="list-style-type: none"> <li>✓ Subtropical humid monsoon climate (average temperature: 17 C°) [6]</li> <li>✓ Annual rainfall 800-1,000 mm/year [6]</li> <li>✓ Annual sunshine 1,300-1,400 hr/year [6]</li> </ul>

### General info on the city

Guangyuan City has a history of over 2,300 years [7], but it is a less developed mountain city in southwest China. The per capita GDP of the city is less than half of the national average, and agriculture is dominant in the economic structure of the city. Guangyuan City has rich natural resources, with exploitable hydropower of up to 1.86 million kW, a natural gas reserve estimated to be over 5 trillion m<sup>3</sup> and a forest coverage rate of 43% in 2014 [8].

### Low carbon re-construction and development of the city

In May 2008, the Wenchuan Earthquake hit Guangyuan City. It caused 4,819 deaths and direct economy loss of over 120 billion RMB (~16.6 billion EUR)[9]. After the earthquake, the city faced the great challenge of re-construction. Based on increasing environmental challenges, the city decided that the re-construction and future economical development should not take place at the expense of the environment. In response to this challenge, the Guangyuan Government put forward the "low carbon re-construction and development" plan and has worked very hard to achieve its goal.

### Experts' advice and institutes' research:

In November 2008, Guangyuan City held the "*Leaders of Universities' Visit to Guangyuan after the Earthquake*" event, which invited famous experts and scholars to visit the city and give advice on the city's re-construction and future sustainable development planning. This was only the start of the road towards low carbon development. In April 2009, Guangyuan City signed a Memorandum of Understanding (MOU) with the Research Centre for Sustainable Development (CRSD) under the Chinese Academy of Social Sciences (CASS), to promote the low-carbon

development of the city. In August 2009, Guangyuan City held the "International Forum on Low Carbon Re-construction and Enterprises" together with CASS and the World Wildlife Fund (WWF) [10]. In July 2010, the research project "Study on Guangyuan's Low Carbon Re-construction and Development"<sup>1</sup> was finalized with five important reports. The "Study on the Challenges and Solutions of Guangyuan City's Low Carbon Re-construction and Development" and the "Study on Guangyuan City's Low Carbon Development Planning" are considered as the foundation of the roadmap for Guangyuan's low carbon development. In August 2010, Guangyuan City founded its own low carbon economic development research institute [11].

#### Policy fostering:

In March 2009, Guangyuan City government formally presented the concept of "low carbon re-construction and low carbon economic development" [12]. At the same time, the government founded the "Guangyuan City Low Carbon Development Leadership Team", whose role was replaced by the Guangyuan City Low Carbon Development Bureau in 2011. The professional advice and good suggestions from experts and research institutes provided a solid foundation for the government's policy making and planning on low carbon re-construction and development. A series of documents and standards were developed and issued, which included the "action plan for promotion of clean energy development and utilization", the "guidelines on the circular economic industrial park construction and low carbon development", the "12<sup>th</sup> five-year low carbon economic development plan of Guangyuan" and the "Guangyuan City's green and low carbon small town construction standards", etc [12].

#### Developing a cleaner energy system:

Relying on its abundant natural gas resources, the City planned the Guangyuan 'natural-gasification' project, aiming to replace the use of coal and oil by natural gas. Activities included construction of a liquefied natural gas (LNG) plant, a natural gas pipeline network, a LNG/compressed natural gas (CNG) gas station and the promotion of LNG/CNG vehicles. By the end of 2014, 78.5% of the urban residents used natural gas for heating, and all the taxis and buses were fuelled by natural gas. At the same time, energy generation from solar, biogas and geothermal sources were widely promoted, especially in rural areas [14].

#### Prioritizing low carbon industry in re-construction:

Guangyuan City has set up strict standards for industry re-construction and new project approvals after the earthquake. Small plants with heavy pollution, like small cement and coking companies, have been closed and new plants are no longer approved. By 2011, the city had established 13 new low carbon industry parks, and 44 new low carbon projects with investments above 100 million RMB (~ 13.9 million EUR).

#### Energy savings in the building industry:

Energy saving technologies and energy efficient building materials have been widely used in re-constructing destroyed buildings and energy saving related retrofitting has been promoted for existing buildings. For the 463 new construction projects, a 50% energy saving standard is strictly enforced for both design and construction (15). LED lights are used in pilot energy saving communities. Moreover, in 2011, the city started a project under the Kyoto Protocol's Clean Development Mechanism (CDM). This project aims to distribute 5 million energy saving lamps free to local residents within a period of three years [16].

#### Low carbon agriculture:

Since 2008, Guangyuan City has put great efforts into low carbon agriculture development. In March 2012, Guangyuan City government started to implement the "action plan for creating a national low carbon agriculture pilot city". As a result of this project, in 2014 the annual CO<sub>2</sub> emission reductions linked to agriculture in the city were estimated to be 1.5 million tons [17]. The main measures implemented to decrease GHG emissions in Guangyuan's agricultural activities cover: 1) the promotion of rural methane production; by the end of 2014 already 85% of rural residents use methane for household utilization; 2) the promotion of soil testing and recommendation of specific fertilization technologies, thus resulting in increased efficiency of fertilization (an increase of efficiency from 30% to 45%); 3) the promotion of recycling of agricultural wastes to the field; 4) the

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<sup>1</sup> The project is funded by the Department for International Development of the UK. CASS and Guangyuan City are the main performers; the University of Cambridge provided support as well.

promotion of no-till cultivation technology; and 5) the promotion and production of "pollution-free agricultural products", "green food" and "organic agricultural products" [15].

#### Low carbon community:

In August 2013, Guangyuan started the "Pilot Low Carbon Community Construction" project. As a result, a series of standards were developed by the government, like "Guangyuan City Low Carbon Resident Community Assessment Standards", "Guangyuan City Low Carbon Pilot Community (Villages) Standards", and "Guangyuan City Low Carbon Pilot Household Standards" [18].

#### Carbon trading:

In 2008, Guangyuan came to an agreement with the US Environmental Defence Fund regarding the implementation of a GHG emission reduction trading system. Generated emission reduction certificates were used to offset emissions from travel to the "Shanghai World Expo" and "Guangzhou Asia Games" in 2010. In April 2011, the Guangyuan Environmental Exchange Institute was founded, which is the first of its kind in the Sichuan Province [19].

#### Public awareness rising:

In 2010, Guangyuan City designated August 27<sup>th</sup> as the "Guangyuan Low Carbon Day" to raise the public awareness of low carbon development.<sup>2</sup> The government also launched the "Guangyuan Low Carbon" website<sup>3</sup>, as well as the journal "Western Low Carbon" [20].

In November 2012, the Chinese National Development and Reform Commission (NDRC) issued the second batch of 29 low carbon development pilot cities, and Guangyuan was included in the list. Following this, in May 2013, the city government issued the "*Guangyuan City Action Plan for National Political Low Carbon City Construction (2013-2016)*". The main targets of the plan are described in the table below [21].

#### Goals of Guangyuan's low carbon city construction

Items	Unit	2005	2010	2015	2020
Carbon productivity	RMB of GDP output/tonne CO <sub>2</sub>	2,900	3,700	4,700	6,200
Energy consumption/ economic intensity	Ton standard coal/10,000 RMB GDP	1.55	1.24	1.01	0.81
None-fossil fuels in primary energy consumption	%	13.2	15.5	18.8	20.0
Energy consumption of public buildings	Kg standard coal/m <sup>2</sup> floor space year	45.6	44.3	43.2	42.1
Energy consumption of residential building	Kg standard coal/m <sup>2</sup> floor space year	31.8	33.6	33.2	32.8
Number of buses per 10,000 residents	/	1.35	2.61	3.6	5.7
Per capita water consumption	L/day	62.5	89.1	95.0	98.2
Forest coverage rate	%	45.2	53.2	55.0	55.5
Per capita CO <sub>2</sub> emissions	Tonne CO <sub>2</sub> /capita	1.08	2.04	2.5	3.0

#### Lessons learned, especially for less or under-developed areas are the following:

- a) Cities should not follow the path of high energy consumption and thus maintain economic growth and only implement environmental protection measures aiming to achieve pollution reductions .
- b) Scientific planning is of great importance, and regional resource advantages should be well utilized.
- c) Promotion of advanced agricultural technologies is important.
- d) Public awareness raising and community promotion are key issues in achieving sustainable development.

<sup>2</sup> In 2013, the date of the "Guangyuan Low Carbon Day" has been changed to June 17<sup>th</sup> to conform to the Chinese National Low Carbon Day.

<sup>3</sup> [www.gydtw.cn](http://www.gydtw.cn)

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