Smart City – Good Practice

Sustainable economic growth

Low-carbon Transition Road Hangzhou pilot project

Hangzhou, China

Low-carbon city transition in Hangzhou

China is currently facing the predicament that greenhouse gas emissions are increasing with the growth of the economy. In order to enable transition from the old development mode into a new low-carbon approach, the National Development and Reform Commission (NDRC) started a low-carbon pilot program in 2010 [9]. Hangzhou has been selected as one of the pilot cities to implement a "low-carbon city pilot project".

The project was implemented in two stages.The first stage lasted from 2010 to 2015, the second one started in 2015 and will last to 2020. Specific carbon emission reduction targets have been set during the initial planing period aiming to reduce carbon emissions by 20% per GDP unit until 2015 and 50% until 2020 [9]. As the city with the highest GDP among the first batch of Chinese cities chosen as low carbon project cities, Hangzhou has set a more ambitious carbon reduction target than the national one. Based on this target, Hangzhou municipal government drafted a more detailed plan, got sufficient local government policy support and covered more social sectors.The low-carbon development transition in Hangzhou was framed as "dominanted by low-carbon industries, based on low-carbon city life and building on low-carbon society" [10]. The low-carbon project includes not only "Low-carbon Development" and "Solution for Climate Change" aspects but also "Ecological Civilization Construction", "Circular Economy Development", "Energy Conservation Demonstration", etc., which cover industry, construction, transportation, ecosystems and waste management sectors.

Country/ City Profile

Source: [14]

Country		City	
Population (2014)	1.364 billion [1]	Population (2015)	9.02 million [3]
Land area (km²)	9.6 million [1]	Land area (km²)	16,596 [4]
GDP per capita (2014, US$, at purchasing power parity)	13,206 [2]	GDP per capita (2014, US$, at purchasing power parity)	15,326 [6]
Region	Asia	Region	East China, Coastal

City's physical geography	**Location**	✓ Located in the northern part of Zhejiang Province, facing Hangzhou Bay to the east. The biggest river in Hangzhou, Qiantang River, is running through most of the city **(flooding risk).** ✓ Located along the Southern Yangtze River Delta, a complex and varied terrain which includes both high mountains (more than 1,500 m a.s.l.) and low altitude plains (3-6 m a.s.l.) [8]. ✓ Mountains and hills cover a total area of 65.6% of the city; plains account for 26.4%, the rest of the city area is composed of rivers, lakes and reservoirs.
	Climate	✓ Subtropical monsoon climate. Alternating winter and summer monsoon, four distinct seasons, abundant sunshine and rainfall (annual average temperature: 15 to 17C°) [8] ✓ Around 1,100-1,600 mm/year annual rainfall [8]

Initiating context

Hangzhou acts as the political, economic, cultural and financial center of Zhejiang province. The city is also famous for its beautiful natural scenery and has the reputation as a "paradise". Hangzhou has been selected as one of the first cities in the batch of "low-carbon pilot cities" in 2010 with high political support. It has also been chosen as pilot city in many other green projects such as "Green low-carbon transportation system construction", "Emission reduction policies demonstration city", etc. Thus, following a low-carbon development strategy has been targeted

by Hangzhou for a long time already, also noticeable due to the implementation of various respective governmental policies [5].

Hangzhou energy consumption in 2013, included 56.8% coal and 22.2% oil [5]. Continuing economic growth is leading to growing environmental constrains [5]. Thus, how to realize the target of doubling GDP in 2020 compared to its 2010 level, while reducing coal consumption, became one of the main challenges for Hangzhou. To comply with China's pilot low-carbon cities aim to decouple economic growth from fossil fuel use (by increasing energy efficiency efforts and the use of renewable energy sources), Hangzhou municipality formed a comprehensive top-down framework for low carbon city transition planning and implementation. In order to realize the carbon emission reduction targets, Hangzhou municipal government initiated a series of low-carbon actions under related policies which cover several social aspects.

Project description

The low-carbon transition project was carried out under a policy framework including both national guidelines and Hangzhou municipality governmental regulations. Both contribute equally to the success of the low-carbon project in Hangzhou. This policy framwork has also been proven to be powerful enough to support planning and implementation of specific measures under the "low-carbon city pilot project", adressing several societal sectors, including industry, building construction, transportation, green space and waste management.

Low-carbon measures implemented in Hangzhou mainly focus on 1) energy conservation in the industrial sector, 2) construction of low-carbon buildings and transportation systems, 3) controlling total waste generation in residential areas and implementing of a waste classification management and 4) knowledge spreading [5].

Implementation processes

The low-carbon planning process began with the municipal governments interest to develop a low-carbon city of Hangzhou. When NDRC issued the Notice in 2010, Hangzhou started planning and implementing the city program [11]. A low-carbon advisory group was established and declared as responsible for decomposing the overall target into annual action plans. Key sectors, such as industry and construction and transportation are considered to reach the carbon emission reduction target. The overall target for Hangzhou was/is to reduce CO_2 emissions by 17% per GDP unit in 2015 and by 45% per GDP unit in 2020 compared to the level of 2005 [9]. Further a share of 70% green public transportation is targeted for 2020 and low-carbon buildings have been aimed to save 65% energy in 2015 [9]. The share of service industry and low-energy consumption industry is aimed to increase to 80% in 2020 [9].

The detailed implementation processes and methodologies are listed in the table below:

Project implementation details [5]	
Energy conservation	✓ Since 2011, both "total energy consumption" and "per unit GDP energy consumption" have been monitored. ✓ Since 2014, seasonal energy reduction targets have been distributed to every district, town, and corporation. Further targets are to: ✓ eliminate old technology and equipment with an energy consumption higher as the national standard ✓ take strict project approval procedures, fully considering current energy consumption (e.g. to eliminate high-energy consumption projects with a higher consumption than the average level and prohibit coal-fired energy intensive projects) ✓ encourage energy trading schemes (energy administration through public trading is key in distributing energy credits to key sectors or new projects) ✓ introduce a strict energy consumption limit and increase the electricity price for extra consumption in the industrial sector ✓ rank energy consumption among corporations, thus providing energy priority to better/lower consumption companies.
Low-carbon buildings	✓ Implement energy conservation demonstration projects among more than 200 governmental buildings and public commercial buildings. ✓ Assessment and review of energy consumption in residential buildings since 2014. ✓ 50% of existing residential buildings and 100% of public buildings should have completed energy conservation renovation before 2015.

Project implementation details [5]	
Low-carbon transportation	✓ In 2008, Hangzhou started to implement a "free public bicycle sharing project". Nearly 70,000 bicycles have been put into the system until the end of 2012. Further targets are to: ✓ promote electrical car renting systems (there are more than 5,000 electrical cars and more than 50 rental stations in the city) ✓ set new emission targets for existing vehicles
Municipal waste management	✓ In 2013, Hangzhou implemented the first food waste management projects. ✓ Collecting municipal waste and, at the same time, using it for electricity generation reduced total food waste about 70%. Further targets are to: ✓ set targets for total waste generation control in consideration of the examination system ✓ investigate a stepwise charging solution for waste treatment costs
Others	✓ Hangzhou built the first "Low-Carbon Science and Technology Museum" in China, with the aim to spread low-carbon concept and knowledge among citizens. ✓ Hangzhou holds "low-carbon" lectures once per month for waste source separation.

Results

Hangzhou promotes a low-carbon life style. Based on governmental subsidies, in residential areas, the first 240 households have installed photovolaic panels for electricity generation [10]. Also waste separation has been promoted in residential areas and has already got a good reputation among residents. In 2013, service industry represented 52.9% of total GDP, which accounts for an increase of 5.5% since 2010 [10]. The public bicycle sharing system is one of the highlights of the low-carbon city pilot project Hangzhou; already 3,000 rental stations providing 84,000 bicycles are spread around the city, serving more than 280,000 people every day [13].

Recognizing that low-carbon city transition can't be realized without the effort from citizens, in 2012, the first low-carbon theme museum in China, Hangzhou "Low-carbon Science and Technology Museum", was officially opened. It provides citizens, especially teenagers, with information on low-carbon knowledge and technology.

Figure 1: Bike rental station [13]

Figure 2: Hangzhou Low-carbon Science and Technology Museum [12]

Lessons learned

The concept of developing a "low-carbon city" is considered as being preformed by the transition from a traditional development mode to a sustainable one. Hangzhou aims to take such a transition, following a carbon footprint reduction path. While there are still a lot of challenges and difficulties to be overcome, the strategy of "Hangzhou Low-carbon City Transition" can be adapted to many other cities in China and abroad. The success of low-carbon transition is based on many different aspects which can be summarized as below:

- Strong policy support
- A combination of specific targets
- Control of carbon emissions from key sectors
- Dissemination of knowledge

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