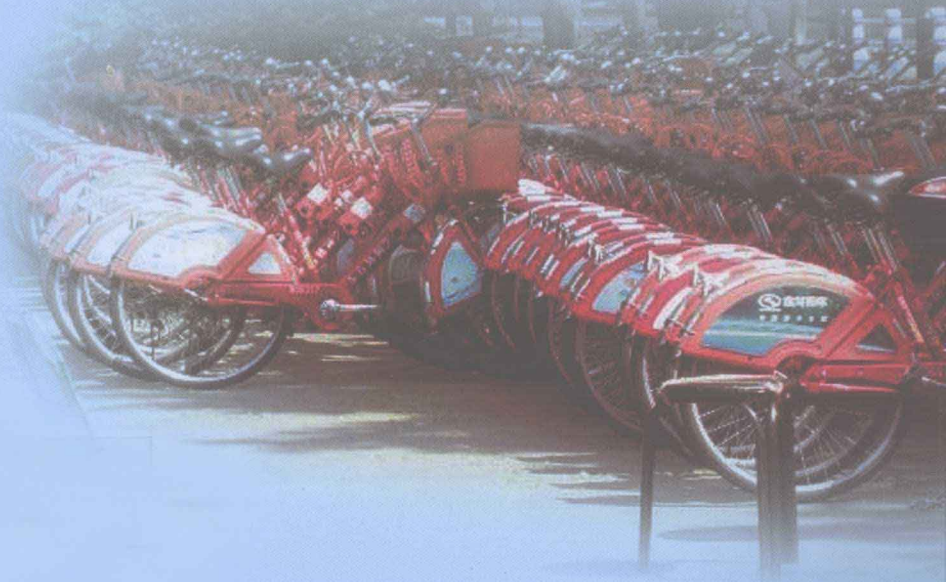


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杭州市打造“低碳城市” 的模式选择与发展策略研究

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全球气候变化已深刻影响着人类的生存和发展，国际社会高度关注，不断探索和纷纷采取应对措施。在诸多应对举措中，旨在降低人类活动造成的碳排放的“低碳”发展模式在世界范围内得到普遍的认同，并成为新时期人类发展的目标。城市是世界各国人口及社会经济的汇集地，城市的碳排放量占全球碳排放总量的 75%，在低碳发展中举足轻重。中国史无前例的城市化进程所带来的大规模能源消耗、资源开发、城市建设对生态环境造成了强烈和持久的影响。因此，探索可持续的城市发展战略已成为实现我国经济、社会和环境发展的核心问题。打造低碳城市成为解决当前问题的迫切需要，为中国城市发展带来了新的契机。

东部沿海发达地区浙江省省会杭州市是我国先行发展起来的城市之一，有能力、有责任也有必要率先探索和实践低碳发展模式，以期为其他城市提供借鉴和示范。然而，低碳城市建设是一项涉及经济、社会、人口、资源、环境等多领域的复杂系统工程，在国内外都是一个新生事物，没有一个标准的模式或者成功的模板以资借鉴。杭州市应选择何种发展模式和哪些发展策略来建设低碳城市，成为摆在研究者面前颇具挑战性的创新课题。

令人欣喜的是，《杭州市打造低碳城市的模式选择与发展策略》一书得以出版，该著作是在著者历经两年多的深入研究后，对上述命题作出科学回答的一种探索。该书以杭州市为研究对象，围绕“杭州市打造低碳城市的模式选择与发展策略”主线逐层演绎，分别从理论篇和案例篇两个维度进行。理论篇梳理了全球气候变化的相关背景，综述了国内外低碳城市发展的相关理论进展和实践，结合杭州市实际进行了 SWOT - PEST 和利益相关者分析，测度并预测了杭州市的碳排放情况，

并提出了杭州市打造低碳城市的发展模式和策略。案例篇挖掘和提炼了杭州市现有与低碳城市发展相关的典型案例和亮点。

细读此书,不难发现作者严谨的科学态度和敢于开拓的进取精神,专著呈现出如下特点。①思路清晰。沿着“问题与机遇剖析(SWOT分析)——影响因素分析(利益相关者)——发展模式——发展策略”的研究思路,层层递进,不断深入,逻辑缜密,思路清晰;②观点新颖。分别从减少碳源和增加碳汇两方面入手,设计了“一个目标、两个途径、多个核心”的全方位立体环绕式综合“低碳社会”发展模式,并从生产、消费、城市森林碳汇等多个角度进行探讨,提出了具有杭州特色的六大发展策略;③方法综合。综合运用SWOT-PEST、利益相关者、IPCC温室气体清单、组合预测模型等多种有效方法对杭州市发展状况进行了全面分析和综合评价,方法先进科学,综合性强;④资料翔实。基于杭州市打造低碳城市的利益相关主体,进行了3次较大规模的公众调查和1次森林经营者调查,多个职能部门和多种类型企业的实地调研,掌握了丰富的一手和二手资料,资料丰富翔实,论据充分、可靠性强;⑤特色鲜明。挖掘了杭州市在各重点领域的亮点和特色案例,包括世界闻名的免费公共自行车、国内领先的低碳社区,多类型特色低碳企业和临安森林碳汇(含全国首个毛竹林碳汇造林项目),为全国低碳经济和低碳城市的发展提供了样板。

综上所述,本书的出版丰富了低碳城市发展研究的内涵,必将推动低碳城市发展研究不断深入,具有重要的理论价值;同时,也为政府职能部门制定相关决策和推动中国低碳城市建设实践提供了决策依据,具有鲜明的实践指导意义。诚然,低碳城市研究是一个快速发展的崭新命题,期待本书作者继续深化并不断拓展研究领域,不断推出更多更好的成果,也期待有更多的学者加盟、参与并推动中国低碳城市发展领域的研究。

浙江农林大学校长



2012年3月

内容摘要

全球气候变化是 21 世纪人类所面临的最严峻挑战之一，国际社会高度重视并积极采取各种应对措施，其中“低碳”发展模式获得了普遍认同。城市既是国家社会、政治、经济、文化的核心载体，也是高消耗、高污染、高排放的集中地，无疑成为低碳发展的重点和关键。我国正处于经济社会快速发展、城市化进程不断加速、碳排放总量日趋增长的重要时期，发展低碳城市意义深远，势在必行。

作为东部发达省份浙江省省会城市的杭州市城市化进程稳步推进，2011 年城市化率达到 51.27%，城镇人口首超农村，工业化水平较高，已跻身于“中上等”发达地区行列。但是，杭州在向高收入水平迈进中受到传统发展模式的制约，当前正处于关键的转型升级时期，因此打造低碳城市是必然选择和明智之举，也是未来发展的动力所在。

本书以杭州市为研究对象，围绕“杭州市打造低碳城市的模式选择与发展策略研究”主线逐层展开，探讨了杭州市打造低碳城市的背景、模式以及策略。全书 9 个章节分为两大部分，前 6 章是第一部分，即理论篇，后 3 章是第二部分，即案例篇。

理论篇梳理了全球气候变化的相关背景，综述了国内外低碳城市发展的相关理论进展和实践，结合杭州市实际进行了 SWOT - Pest 和利益相关者分析，测度并预测了杭州市的碳排放情况。在上述研究基础上提出了杭州市打造低碳城市的发展模式和策略。案例篇挖掘和提炼了杭州市现有与低碳城市发展相关的典型案例和亮点。各章节的研究内容与结论如下：

第 1 章梳理了全球气候变化及其应对措施的相关背景，扼要介绍了杭州市概况（自然资源条件与社会经济条件）以及本书的研究目标、内容、研究思路，遵循参与性诊断——参与性设计的逻辑框架介绍了采用

的主要研究方法。

第2章综述了国内外低碳城市发展的相关理论进展和实践,阐述了低碳经济、森林碳汇与低碳城市建设的内在逻辑联系,依次归纳了其特征和研究进展,重点切入低碳经济和低碳城市的发展策略、政策以及发展评价,并对国内外低碳城市发展实践模式进行了分类总结,可为杭州市乃至我国低碳城市发展模式的研究提供借鉴与启示。

第3章运用SWOT-PEST分析方法对杭州市打造低碳城市的内部优势和劣势、外部机遇和挑战进行系统分析,据此提出SWOT策略,为后续研究提供基础铺垫。探讨了杭州市作为一个经济比较发达而能源极度匮乏的城市,生态环境良好、工业化、城市化进程不断加速的国际旅游之都,在现阶段是否具备了打造低碳城市的基础,其必要性和可行性如何。

第4章在对利益相关者概念和分类进行阐述的基础上,基于米切尔分类法界定了杭州市打造低碳城市的利益相关主体,主要包括政府、企业、森林经营者、公众等。通过政府、企业关键信息人访谈、森林经营者、公众问卷调查等大量实地调研对上述主要利益相关主体展开研究,分别探讨了各类主体对杭州市打造低碳城市的认知、作用和需求意愿。以公众为例,一次杭州市公众调研得知有60.54%的公众知道杭州市正在打造低碳城市,信息来源渠道主要是新闻媒介,94.22%的公众表示杭州市打造低碳城市有必要。森林经营者参与低碳城市建设的主要作用是参与碳汇林的经营,调查得知84.17%的受访农户对于碳汇交易持支持态度。Logistic计量模型结果表明,农户受教育水平越高,家庭劳动力越多,对森林改善生态环境的功能认识越强,越倾向于参与森林碳汇交易。而林地面积越大,越不愿意参与碳汇林的经营。

第5章探讨了杭州市低碳城市发展模式的选择。首先依据IPCC温室气体清单方法,对杭州市2000~2010年碳排放量进行了测度,利用GM(1,1)和ARIMA(1,2,1)的组合预测模型,预测了杭州市未来几年的碳排放量和排放强度走向,并分析了杭州市碳排放的主要影响因素。研究表明杭州市已基本具备了综合型“低碳社会”模式的条件和一定的实践基础,据此提出“一个目标、两大途径、多个核心”的全方位立体环绕式综合“低碳社会”发展模式。“一个目标”是低碳发展目标,

重点在低碳，目的在发展。“两大途径”指尽可能减少碳源，增加碳汇，两大途径最终都是促进绝对碳排放量的减少，而要实现杭州市低碳发展目标，则需要从工业、建筑、交通、消费、森林碳汇等多个核心领域入手。本章围绕低碳生产模式、低碳消费模式、森林碳汇模式的选择依据、主要建设内容和相关政策建议展开论述。

第6章提出了杭州市打造低碳城市的发展策略。低碳城市发展是一项复杂的系统工程，为了实现杭州市综合“低碳社会”发展模式，需要从多维度设计其发展策略。本研究立足杭州市实际情况，充分挖掘杭州市特色，提出杭州市打造低碳城市应重点采取以下六大发展策略，即提升现代服务业与建立清洁生产相结合，发展特色低碳产业；推进城市能源结构调整，实现优质清洁能源的综合利用；构建立体式多功能城市生态系统，建设“清凉杭州”；建设低碳示范社区和低碳教育载体，引导低碳消费；构建“五位一体”交通体系，促进低碳交通消费；发展绿色建筑，实现和推广城市建筑低碳化。

第7章即案例篇第1章集中探讨了低碳生产模式案例，从案例企业所处的产业类型，采用的低碳技术，企业规模多样性角度出发选择了五类典型企业。调查企业涉及新能源产业与节能减排领域，新能源产业包括电动汽车和太阳能光伏企业，节能减排企业包括余热发电、废物综合利用等。对五家企业的概况、低碳项目背景、成效、存在的问题、发展前景进行了介绍，从政策扶持、企业意识、公众认知和需求意愿多个角度探讨了各项目实施现状以及发展潜力。并最终由点及面归纳和引申出杭州低碳生产发展模式的重要启示和经验借鉴。

第8章是低碳消费模式的案例研究，选择了杭州市世界闻名的免费公共自行车和国内领先的低碳社区案例。分别介绍了两个特色案例的实施背景、运营模式、实施成效及社会评价。公共自行车交通系统已成为杭州市打造低碳城市的重要手段，它不仅改变了广大市民的出行消费方式，也改变了整个城市的发展模式，同时为国内外其他低碳城市建设提供示范效应，已成为杭州市一张声名远播的城市名片。低碳示范社区——下城区作为杭州市的一个缩影，低碳实践涉及方方面面，市民作为城市社区生产消费活动的主体，从其生活消费模式角度探讨低碳社区建设有很大的必要性和现实性，同时也是低碳社区建设的主要切入点，

该案例集中探讨了低碳社区建设和管理对市民生活、工作和消费的影响。

第9章介绍和讨论了森林碳汇模式的相关案例。森林碳汇无疑是应对气候变化的重要举措，但鉴于其实施的复杂性和不确定性等因素，国际社会对其态度经历了从谨慎到开放的转变，反映了该模式的不可替代性与巨大优越性，预示着森林碳汇发展的巨大前景。本章重点介绍了临安森林碳汇模式和全国首个毛竹林碳汇造林项目实施的背景、运营情况、收益情况及存在的问题，深入探讨了影响森林碳汇模式选择的因素。研究认为杭州市森林碳汇发展要做到政府重视，科学规划；市场运作，多方支持；广泛宣传，多方参与。

Abstract

The global climate change is one of the most serious challenges that being faced in the 21st century for human, it has been paid more attention for all over the world. Among all the responses to climate change, the “low – carbon” development has gained widespread appreciated. City is not only the core of country’s social, political, economic and cultural, but also the location for high consumption, pollution and emission. It undoubtedly becomes the key point of the low – carbon development. China is in the important period which the economy and society develops rapidly; the process of urbanization accelerates constantly and carbon emissions gross increase gradually. Therefore, it’s meaningful and necessary to develop the low – carbon city .

As the Zhejiang provincial capital city in the developed eastern provinces, the process of Hangzhou city’s urbanization progresses steadily. The urbanization rate is 51.27% in 2011; the urban population firstly exceeds the rural areas and the high level of industrialization has made Hangzhou to be the middle and upper ranks in developed areas. However, It is constrained by the traditional development model on the way to the high income level and a critical period of transition has coming, so it’s an inevitable and wise choice, also, the driving force of future development for building the low – carbon city in Hangzhou.

This book takes the Hangzhou city as the case study, and rounds the main idea “research on the model choice and development strategies of building the low – carbon city in Hangzhou” to discuss the backgrounds, patterns, and strategies of Hangzhou to build the low – carbon city. The nine chapters in this book divide into two parts; first six chapters are the first part, which is the theoretical part; the last three chapters are the second part, which is the

case part.

The theoretical part combed the relative background of global climate change, and reviewed the related theoretical progress and practices of low – carbon city development in domestic and overseas. According to the statu quo of Hangzhou, iut made SWOT – PEST and stakeholder analysis to measure and predict the carbon emissions situation of Hangzhou . On the basis of the above study, it put forward the development models and strategies of Hangzhou to build low – carbon city. The case part excavated and refined Hangzhou’s current typical cases which related with low – carbon city development. The research content and conclusion of each chapter is as follows:

Chapter 1 combed the relevant background of global climate change and the responses, briefly overviewed the statu quo of Hangzhou (conditions of natural resources and socio – economic) and the research object, content and ideas of this book. It Keep the research framework of the participation diagnosis—design to introduce the main research methods.

Chapter 2 reviewed the related theoretical progress and practices of low – carbon city development in domestic and overseas, and explained the inner logical relation among low – carbon economy, forest carbon sequestration and the construction of low – carbon city; successively summarized its characteristics and research progress, and focused on the development strategies, policies and evaluation about low – carbon economy and low – carbon city. Moreover, it classified and summarized the low – carbon city’s development practice models in domestic and overseas, provided reference and enlightenment for low – carbon city’s development model of Hangzhou, even the whole country.

Chapter 3 used the SWOT – PEST analysis method to systematically analyze the internal strengths, weaknesses, and external opportunities and challenges of Hangzhou to build the low – carbon city, and then proposed the SWOT strategies to provide a basis for the further study. It discussed that as a city with relatively developed economy but extremely short energy and a international tourism metropolis with good ecological environment, accelerating

process of industrialization and urbanization, whether Hangzhou has the basis to build the low – carbon city at current stage, and its necessity and feasibility.

On the basis of the concept and classification of stakeholders, chapter 4 defined the stakeholders of building low – carbon city in Hangzhou city by Mitchell classification method, mainly including government, enterprise, forest operators and the public, etc. It discussed the stakeholders respectively based on a large number of field interviewes on government and key information people in enterprise, forest operators and the public survey, argued each stakeholder's recognition, role, need and will for building low – carbon city in Hangzhou. Taking the public as example, from public survey in Hangzhou, 60.54% of public people knew that Hangzhou is building the low – carbon city, and the main information source channel is through news media; 94.22% of public people showed that it is essential for Hangzhou to build the low – carbon city. The main role for forest operators involved in the construction of low – carbon city is to participated in the forest management for carbon sequestration. According to the survey, 84.17% of the farmers supported the carbon sequestration trading. The results of logistic econometric model showed that the higher level of farmers' education, the more family labors, the stronger awareness of the forest's function on improving the ecological environment, more willingness to participate in forest carbon sequestration trading. While the larger woodland area, more unwillingness to participate in operating the carbon sequestration forest.

Chapter 5 discussed the choices of the low – carbon city's development model in Hangzhou. Firstly, based on the IPCC greenhouse gas inventory method, it measured hangzhou's carbon emission from the year of 2000 to 2010; also, it take use of combination forecasting model of GM (1, 1) and ARIMA (1, 2, 1) to predict Hangzhou city's trend of carbon emissions load and emission intensity in the next few years, and analyzed the main factors that influence the carbon emissions in Hangzhou city. The research showed that Hangzhou city has basically possessed the conditions of comprehensive

“low – carbon society” model and the certain basis of practice. Therefore, it proposed the Omni three – dimensional surround comprehensive “low – carbon society” development model of “A Target, Two Main Ways, Multiple Cores”. “A Target” is the goal of low – carbon development, the key point lies in low – carbon, and the aim lies in development. “Two Main Ways” referred to decrease the carbon source as far as possible and increase carbon sequestration; the two main ways eventually promoted the reduction of the absolute carbon emissions. To achieve Hangzhou’s low – carbon development goals, it need to proceed from multiple core areas such as industry, construction, transportation, consumption, forest carbon sequestration etc. This part argued the choice basis, main construction content and some suggestions according to the low – carbon production, low – carbon consumption and forest carbon sequestration model.

Chapter 6 proposed the development strategies to build the low – carbon city in Hangzhou. The development of low – carbon city is a complex systematic project. In order to realize the “low – carbon society” development model of Hangzhou, it need to design its development strategies from multiple dimensions. This study is based on statu quo of Hangzhou; it fully excavated its unique features; proposed to take the following six development strategies on building the low – carbon city in Hangzhou. They are the combination of improving the modern service industry and the establishment of cleaning production; development of the characteristic low – carbon industries; promote the adjustment of urban energy structure to realize the comprehensive utilization of high – quality clean energy; construct the stereo metric and multifunctional urban ecosystem to develop “Cool Hangzhou”; construct the low – carbon demonstration community and low – carbon education carrier to conduct “five in one” transportation system to promote the low – carbon transportation consumption; develop the green buildings to achieve and extend the low – carbonization of urban buildings.

Chapter 7 is the case part, which focused on the case of low – carbon production model. It chose five typical enterprises from the industry types,

the low – carbon technology which were applied, the diversity aspects of enterprise scale. The enterprise investigation involved the new energy industry, energy conservation and emission reduction. The new energy industry included electric cars and solar photovoltaic industry; the energy conservation and emission reduction enterprise included cogeneration, waste comprehensive utilization and so on. This chapter introduced five enterprises' general situation, background, effect, problems and prospect of their low – carbon project. It discussed each project's implementation current situation and potential from multi fields such as policy supporting, enterprise awareness, public recognition, need and willingness. Finally it summarized the important inspiration and experiences about the development model of Hangzhou low – carbon production.

Chapter 8 is the case research of the low – carbon consumption model. This chapter chose Hangzhou's world famous free public bicycle and low – carbon community as cases. It described these two characteristic cases' implementation background, operation model, effects and social evaluation respectively. The public bicycle transportation system has become an important way to build the low – carbon city in Hangzhou. It not only changed the general public people's travel consumption way but also changed the whole city's development model. At the same time, it provided the demonstration effect for the construction of other low – carbon cities in domestic and overseas, and has become one popular city's name card in Hangzhou. The low – carbon demonstration community – Xiacheng area, as a microcosm of Hangzhou city, the low carbon practice in this community involved all aspects. As the subject of city's production and consumption activities, it is very necessary to discuss low – carbon city construction from the view of the citizens' lives and consumption. Meanwhile, it is also the main point of the low – carbon city construction. This case mainly explored the impacts on citizen's lives, work and consumption from low – carbon community construction and management.

Chapter 9 introduced and discussed some relevant cases of forest carbon sequestration model. There is no doubt that the forest carbon sequestration is

an important measure to deal with the climate change. However, in the view of its implementation's complexity and uncertainties and other factors, the international community shifted its attitude from curiosity to openness, which reflected the non-substitutability and huge superiority of this mode, and indicating the tremendous prospects of development about forest carbon sequestration. This chapter mainly introduced Lin'an's forest carbon sequestration model and the implementation background, operating situation, earnings, and the problems of the first bamboo carbon sequestration forestation in China, it made deeply studies on the factors that influencing the choice of forest carbon sequestration model. The study considered the development of Hangzhou forest carbon sequestration should be attracted government's high attention, make scientific planning; build market operating and multiple support and involvement mechanism; get widely supported from public.

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