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Implications and future direction of greenhouse gas emission mitigation policies in the building sector of China



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ABSTRACT

A common starting point in assessing greenhouse gas (GHG) reduction policy implications in the built environment is to look at industry specific policies. This paper addressed the glaring gap between national all-economy policy options that actually determine industry-specific programs, and their downstream impacts and implications to the building and construction sector. National carbon policy schemes were organised into two basic types: indirect pricing mechanisms, and direct pricing mechanisms. Their features and comparative strengths and limitations were critically reviewed under a common framework, drawing from a wide body of literature. The status of the application of the GHG reduction policies in China was reviewed. A green building case is studied to quantitatively present the effectiveness and deficiencies of the current GHG mitigation policies in the building sector of China, and their implications to a building's life cycle. Based on China's current status of the policy system, this paper identifies the future direction of building's GHG mitigation policies of China. Policies directly aiming to GHG mitigation in the building sector should be implemented in holistic and comprehensive pathway, to balance the costs and benefits of the stakeholders for the promotion of building GHG mitigation technologies.

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1. Introduction

Global warming is considered as one of society's greatest and most important challenges today because of the potential range and severity of impacts to communities, and to our natural and built environments [1]. Unmitigated greenhouse gas (GHG) emissions would cause further warming and adverse impacts not just in this century but also beyond. Thus, a wide range of policy and technological solutions are being studied or adopted by many national governments and organizations to reduce GHG emissions. Many countries, including China, have made GHG mitigation commitment and set quantitative reduction targets [2]. Considering the high speed of economic development, the Chinese government has made a GHG emission reduction commitment by 2020, which is measured in GDP. To ensure the realization of the emission mitigation target, multi activities have been processing in China. Specific objectives for GHG mitigation has been brought into the Twelfth Five-Year Plan (2011–2015) of China, such as establishing emission auditing system, certification system for low carbon products, emission trading market etc. [3,4]

About 33% of all energy related GHG emissions globally are from energy consumption in commercial and domestic buildings [5–7]; this contribution increases if the GHG emissions from the manufacturing and transport of construction products (i.e. the “embodied carbon” in products and buildings) are also considered. The cost efficiency of GHG emissions mitigation or carbon abatement efforts is considered to be the highest or most favourable in the building sector compared to other sectors [8,9]. With more than 44 billion square meters of existing building stock [10], it is estimated by the government that about 30 billion square meters of new buildings will be added in China by 2020 [11]. The building sector has one of the fastest growing energy consumption trends today and that extends into the future in a business-as-usual scenario. As a matter of fact, achieving the emission mitigation potential is especially paramount in China [12].

But for the large part, the building and construction industry has been mostly reactive to national GHG emissions policy debates or setting. The exception to this situation is the proactive efforts of industry or market-based building organizations that promote voluntary green building ratings (e.g. in the US, UK, Australia, etc.) and also advocate GHG mitigation policies and initiatives (e.g. [13]). An industry that has both significant contribution to GHG emissions and huge potential for mitigation could contribute more positively to public policy debates if there is better understanding of the downstream or industry-specific implications of high-level, national or all-economy GHG mitigation policy options. The Chinese Ministry of Housing and Urban-Rural Development (CMO-HURD) promised that newly built green and sustainable building will reach no less than 65% in cities by the end of 2015 [14]. Promoting green and sustainable buildings has been a priority of the national GHG emission reduction plan of China.

Many barriers exist for applying sustainable technologies, such as high upfront investment costs, long pay back periods, difficulty in quantifying the benefits of sustainable building etc. [15–17]. Policies from the government are needed to remove the barriers caused by external diseconomy of GHG emission reduction. Recent researches looked at the potential of the adoption of technologies in new buildings in different US cities or regions (e.g. [18]), sophisticated modelling of consumer adoption of incentives or rebates in the residential sector (e.g., [19]), mitigation opportunities in developing countries using existing mechanisms of the United Nations Framework Convention on Climate Change (UNFCCC) [20], appropriate political measures to improve the energy performance of existing dwellings in Korea [7] and the effectiveness of different policy instruments considered best-practice examples from about 30 countries and country groups [6,21]. These studies provide useful and practical insights of the implications of building sector specific policies and initiatives. The researches about GHG mitigation policies in the building sector of China are relatively much fewer. Barriers, policies and appropriate technologies of building's energy efficiency in China were discussed in previous researches [22–26]. The possibility and implementation method of some specific policy instrument were analysed, such as clean development mechanism (CDM) [12,27] or energy performance contracting (EPC) [28]. However, the implications and effectiveness of the current policy system aiming to GHG mitigation in the building sector of China are unknown to date.

This paper aims to review first the broad GHG mitigation policy options and features in a framework and context relevant to the building sector, and then China's policies related to building's GHG mitigation. A green building case is studied to quantitatively present the effectiveness and deficiencies of the current GHG mitigation policies in the building sector of China. Based on China's current status of the policy system, this paper identifies the future direction of building's GHG mitigation policies of China.

2. GHG mitigation policy options

2.1. General types and classifications

The plethora of national or jurisdictional (e.g., state or province) policies and programs that aim to reduce GHG emissions are categorized and presented in Table 1. Some of the schemes have been implemented only in a specific sector, some are implemented across a number of sectors, and others are applied across the whole economy. For simplicity, these policies can be classified further into two primary approaches:

- Indirect pricing ('Regulations and incentive instruments' in Table 1);
- Direct pricing ('Direct pricing instruments' in Table 1).

Table 1

A taxonomy of GHG emissions mitigation policies.

Policy types	Contents and examples
Regulations	
Laws and regulations	Energy/water/other resources conservation, renewable energy production, GHG emission mitigation, climate change
Government goals and plans	Government commitment, national plan, technology development plan
Regulatory rules	Construction process, building operation, government procurement, specific rules for public buildings or infrastructures
Mandatory standards and codes	Building design, building construction, building appliances
Incentive instruments	
Economic incentives	Subsidies, rewards, financial privilege, energy performance contracting, taxes (not for GHG emissions, such as fuels)
Informative incentives	Voluntary certifications or labelling, technology promotion, information provision, pilot and demonstration, advertising, education
Direct pricing instruments	
Carbon taxes	Domestic, tariff
Emission trading scheme	Cap-and-trade, clean development mechanism

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