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Promoting energy efficient building in China through clean development mechanism

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HIGHLIGHTS

- Eight types of significant barriers to the implement of EEB are identified.
- The sources and roots of barriers are verified with the industry professionals.
- Benefits of CDM to EEB are discussed.
- There is limited awareness of CDM in building sector.
- Overcoming or alleviating these barriers through CDM and other sources are proposed.

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ABSTRACT

This study aims to investigate the barriers which impede the promotion of Energy Efficient Building (EEB), and to propose solutions to alleviate these barriers by capturing the benefits from Clean Development Mechanism (CDM), in the context of China. Through comprehensive literature review, eight types of significant barriers are identified, including weak enforcement of government policies, market inefficiency, information barrier, small and scattering buildings, fragmentation of the construction industry, perceived high risk, higher initial cost, and difficulty in energy management. To overcome the barriers, the potential of CDM to facilitate EEB promotion is then discussed. These barriers are verified and potential solutions are tested with a questionnaire survey conducted among five professional groups in China, i.e. designers, project managers, quantity surveyors, marketing managers and property managers. The results suggest that they generally identified with the barriers. However, their limited awareness of CDM implies that corresponding policies should be formulated and implemented to improve their capability of providing more EEBs with CDM.

1. Introduction

Over the last 30 years, China's annual average growth rate of gross domestic product (GDP) in real terms was nearly 10% (Bosworth and Collins, 2007). Though speedy, China's development pattern to date has resulted in not only social and regional imbalances, but also high emission, resource consumption, and environmental destruction. Now China, as the world's largest energy user (IEA, 2010), with relatively high energy consumption per unit of Gross Domestic Product (GDP) (Richerzhagen et al., 2008), is facing mounting pressure to deal with increasing concerns about energy security. Apart from domestic conditions, western countries' efforts to compete in the green development race are pushing China to adjust her position in the international arena. During the period 2006–2010, China reduced the energy intensity of its economy (a close measure to carbon intensity) by 20% (Zhang et al., 2011), through strict energy conservation and emission reduction measures, whilst it still managed to maintain an average economic growth rate of over 10% in real terms per year. China's current commitment is to decrease its carbon emissions intensity (per unit of GDP) by 40–45% by 2020 as compared to 2005 (State Council of China, 2009). However, China's per capita GDP will have doubled by 2020, implying that both total and per capita emissions will continue to rise.

China should not copy the past industrialization model of developed countries (World Bank, 2012). To maintain growth impetus while being responsible for global consensus, the process of "going

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green" becomes essential and urgent for China. Green development enables a growth pattern with less dependence on resource use, less carbon emission and hence less environmental damage, thus promoting sustainable growth. Through CDM, a new green product market is created. The market will give rise to an environment more conducive to green technology developments and investments, and cultivation of green consumption behaviors (World Bank, 2012).

China is experiencing an unprecedent urbanization process. China and India alone are hosting more than half of the world's new construction (Laurenzi et al., 2007). Buildings consume around 32% of the world's resources, account for about 40% of global energy use and generate up to 30% of GHG emissions (WGBC, 2010). Energy efficient building (EEB), reducing the demand of energy during the life cycle of the building, has the greatest potential of carbon emission reduction and the energy savings can offset the incremental investment (IPCC, 2007; Enkvist et al., 2008; Wang and Zhang, 2008; Morrissey and Horne, 2011; Mahlia et al., 2011). Besides massive saving on natural and economic resources, EEB has other benefits such as energy supply security, new business opportunities and employment creation (Kua and Lee, 2001; Richerzhagen et al., 2008). Hence promoting EEB in China has good potential for contributing to the transformative process of the economy, the society, the environment, and the role of government (World Bank, 2012).

Chinese government has enacted a wide range of energy efficient policies and offered some corresponding financial supports in the building sector. Nevertheless, the enforcement of EEB in China is still weak and its proportion in new buildings is small. Meanwhile, domestic carbon trading market and carbon tax are still under development. CDM is thus the only market based mechanism to stimulate sustainable development and reduce carbon emission in China (Han et al., 2012), at least for the time being. CDM has already attained a several-billion-euro market value and EEB is becoming a primary target for CDM project developers (Schneider, 2007; UNEP, 2009). However, there is no single EEB-CDM project in China yet.

In order to design effective policy to promote EEB and realize the potentials of CDM in the building sector, this paper addresses two objectives: (1) verify the barriers of EEB promotion and their causes, and test the potential of CDM in facilitating the promotion of EEB in China; (2) reveal EEB information availability, professionals' experience related to EEB, and their expectations of EEB and CDM. To achieve these objectives, a survey was conducted on construction industry professionals working in the most urbanised Chinese cities. The perception of professionals reflects the situation in China because they are the front line practitioners. The collective perception of professionals would determine how resolute they would be in making use of CDM to build more EEBs. Based on an extensive literature review, we believe that it is the first empirical survey of front line practitioners to understand the causes undermining the taking up of EEB in China. In addition, the eight barriers that we have identified also help us understand an interesting phenomenon: Why is CDM popular in other sectors in China, but just not in the building sector, though China is the major user of CDM in the world? These eight barriers have prevented the industry from fully capturing the energy saving potential of EEB. Moreover, due to lack of economy of scale, for individual buildings, the income generated from certificated emission reduction is not enough to justify the CDM's transaction cost. Our survey also indicates that practitioners do not have enough faith in the effectiveness of CDM to promote EEB.

2. Literature review

2.1. The benefits of CDM

CDM stems from the Kyoto Protocol as a part of United Nations Framework Convention on Climate Change (UNFCCC). Under the Protocol, countries listed in its Annex I (industrialized countries, such as the UK, Japan, France and Canada, etc.) are committed to reduce their GHG emission by about 5 percent compared with their 1990 levels from 2008 to 2012. Apart from their own efforts in such reduction, these developed countries (or their corporations) can help finance GHG-reduction projects in non-Annex I countries (developing countries such as China, India, Malaysia, etc.) in return for Certified Emission Reductions (CERs) credits for meeting their own quantified reduction targets.

CDM as a market-based mechanism is a more effective means of supporting sustainable development in comparison with prescriptive regulations (Cosbey et al., 2007; Lu et al., 2012). Unlike carbon trading and carbon tax which have negative effects on Gross Domestic Product (GDP) (Stern, 2006; Grubb et al., 2009; Dinan and Rogers, 2002), it could stimulate international investment and provide the essential resource for cleaner economic growth (Fenhann et al., 2004). CDM introduces foreign investments from developed countries to transfer capital and clean technology, thus helping developing countries with their domestic economy, creating new employment opportunities and improving environment. It also provides a good opportunity for developing countries to adjust their industrial structure to achieve a more sustainable and eco-friendly economy. Meanwhile, CDM is a win–win strategy. It allows industrialized countries to invest in emission reductions wherever it is the cheapest globally (Grubb, 2003).

Many studies conclude that CDM, due to its many features, can help professionals overcome the barriers of promoting EEB. Cheng et al. (2008) summarize six main features. First, the introduction of "Programs of Activites (PoA)" in CDM in December 2005 largely facilitates the capture of CDM benefits. It can include and consolidate a large number of interrelated projects, even in different locations, into a single CDM project. According to Hinostroza (2007), the characteristics of PoA include: multiple locations, one coordinating entity, unlimited number of CDM Programme Activities (CPAs), same methodology for all CPAs, no registration fee for adding new CPAs after validation, different durations, flexible monitoring and verification. The problems such as high transaction cost per building/activity, management difficulties, dispersed building locations can be effectively dealt by PoA through economy of scale.

Second, a standardized methodology is required for all CDM projects and the information about successful CDM projects can be disseminated by the UNFCCC through their website. Therefore, other project promoters can benefit from learning from these case studies. It would also increase the number of certain types of EEB registered with CDM by repeating successful examples. Such benefits have been reaped in power plant CDM projects in China (Ellis and Kamel, 2007; Schneider, 2007).

Third, its rigorous registration and certification requirements could positively change end-user behavior (Cheng et al., 2008). As demonstrated in a CDM hotel project–ITC Sonar Hotel in India, it has cultivated a proactive attitude toward energy saving in the project (Cheng et al., 2008; Singh et al., 2011).

Fourth, it can finance EEB projects and bring about the desired market transformation (Figures and Bois, 2006). It reduces various financial risks inherent in EEB through its quality control mechanism, encourages clients to make informed EEB investment decision based on life-cycle analysis, and provides complementary funding for EEB projects through issuance of Certified Emission Reductions (CERs) (Singh and Michaelowa, 2004; Cheng et al., 2008). Li and Colombier (2009) found out that, under the CDM framework, the price of CERs generated by EEB project is slightly higher than average CERs price of CDM projects in China.

Fifth, CDM can serve as a green label which would improve corporate image (Piet et al., 2009). This has been one of the main