

# **A Review on Barriers, Policies and Governance for Green Buildings and Sustainable Properties**

T.M. Leung and C.K. Chau <sup>1</sup>

Department of Building Services Engineering, The Hong Kong Polytechnic University,  
Hong Kong

Thomas P. Lützkendorf and M. Balouktsi

School of Economic and Business Engineering, Karlsruhe Institute of Technology, Germany

---

<sup>1</sup> Corresponding Author E-mail: [chi-kwan.chau@polyu.edu.hk](mailto:chi-kwan.chau@polyu.edu.hk) , Tel: (852) 2766 7780, Fax: (852) 2765 7198

# **A Review on Barriers, Policies and Governance for Green Buildings and Sustainable Properties**

## **ABSTRACT**

*The worldwide sustainability movement has led to growing demands for green buildings and sustainable properties. In response, many governments took the leading role in green or sustainable building development by making public buildings greener. Voluntary initiatives have also been emerged to encourage green building development. However, the market penetration rates of green or sustainable buildings are often far below anticipation. This is due to different barriers to green development. Besides, the benefits arising from green buildings do not appeal attractive enough for or may not be realized by stakeholders. In order to acquire deeper penetrations, policies and institutional governance have to be formulated to encourage more green building developments. This paper is intended to reveal the types of policies that have been implemented by various governments to overcome different types of barriers to green or sustainable building developments. Also, potential government policies and institutional governance have been identified by reference to those implemented for improving building energy efficiency.*

**Keywords:** Green Buildings; Sustainable Buildings; Policy; Barriers; Instruments.

## **1.0 INTRODUCTION**

Buildings consume various natural resources and produce a lot of unwanted emissions. In response, many green buildings have been evolved with an objective of minimizing resources use and unwanted emissions. Although green buildings have been growing in numbers, the rate of increase is lower than anticipated. A number of barriers to green building developments have been identified. Up to date, only a limited number of government policy instruments have been implemented to overcome these barriers. Accordingly, this paper intends to identify the types of policies and governance that have been implemented to overcome these barriers. Also, potential government policies and institutional governance will be identified by reference to those implemented for improving building energy efficiency. In fact, green buildings represent an approach for improving sustainability in the construction sector; they focus on the issues of resource conservation as well as climate and environmental protection and are expected to contribute to better health, ease and comfort. Sustainable buildings go beyond these issues and incorporate aspects of life cycle cost, recoverability, functional and technical quality as well as user satisfaction. Although this contribution focuses on the topic of green buildings, it also brings forward issues related to sustainable buildings. In Germany, whose development is compared with that of Hong Kong, the transition to consideration of sustainable buildings has already been accomplished. In doing so, questions concerning resources conservation as well as climate and environmental protection are an essential aspect of the problem.

## **2.0 BARRIERS TO GREEN BUILDINGS**

Many barriers have been found to hinder the development of green buildings. Table 1 lists different types of these barriers

### **2.1 COMMODITY-RELATED BARRIERS**

Improper definition of green building within a policy may hinder green development. Green buildings also encompass widely diverse environmental issues with incompatible measurement scales. The assessment of some environmental issues may involve some value judgment. They may not be easily appreciated by stakeholders. Often, detailed definition of green buildings has been laid down within building environmental assessment schemes. Unfortunately, highly technical character of credit definitions, aggregation of radically different types of elements into a single score, and the bureaucratic complexity of the assessment method creates additional knowledge barriers to green building (Schweber, 2013). On the other hand, there is also progress being made in this direction. With the international standards ISO 15392:2008 Sustainability in building construction - General principles and ISO 21929-1:2011 Sustainability in building construction - Sustainability indicators - Part 1: Framework for the development of indicators and a core set of indicators for buildings foundations have already been laid. Although these standards formulate the requirements for sustainable buildings and determine specific assessment criteria, are still not well enough known and receive in general little attention.

Barrier Categories	Barriers
<b>Commodity-related barriers</b>	<ul style="list-style-type: none"> <li>• Definition of green buildings</li> <li>• Quantification of benefits</li> <li>• Lack of knowledge and awareness</li> </ul>
<b>Process-related barriers</b>	<ul style="list-style-type: none"> <li>• Funding issues</li> <li>• Split incentives and appropriability</li> <li>• Risk and uncertainties</li> <li>• Lack of measureable requirements</li> <li>• Lack of communication among project team members</li> </ul>
<b>Organization and personal behavioral barriers</b>	<ul style="list-style-type: none"> <li>• Lack of commitments from the administrative leaders</li> <li>• Lack of communication between the public and administration</li> <li>• Personal resistance to change</li> <li>• Lack of incentive</li> </ul>

TABLE 1: BARRIERS TO GREEN BUILDING DEVELOPMENT

The prime concern for a majority of building investors/owners is whether sustainable development will incur higher first costs regardless of whether long-term benefits will be offered. Even some stakeholders may realize some of the operating and intangible benefits of green buildings, many are uncertain about the size and type of those benefits (Issa et al., 2010). So far the real estate industry has mostly focused on demonstrating the economic benefits of energy efficient buildings. There are some first results (European Commission, 2013). The problem is that often the physical characteristics of the buildings are not captured in the databases of transactions - this complicates empirical analyses. On the other hand, incentives may not be properly appropriated among stakeholders. If the investors will sell the properties after they have built, they may not want to invest in green buildings. Tenants may not invest if they are likely to move out before fully benefiting from the benefits arising from green buildings.

The lack of public awareness can be a barrier to green buildings (Samari et al., 2013). A lack of knowledge of constructors / designers on green buildings creates additional barrier. At the same time, investors may see risk and uncertainties when making decisions on green or sustainable buildings. Green buildings often involve application of new technologies. They may pose risks of not deliver the desired performances in a timely manner. Uncertainties about the costs and benefits also create barriers in getting across the financial information necessary to inform decision makers.

## 2.2 PROCESS-RELATED BARRIERS

The process of developing green buildings itself can also create some barriers. The complexity of green buildings inherits practical difficulties in defining measurable requirements. The diverse nature of green building requires not only full cooperation and effective communication among project team members, but also requires close

interaction of suppliers, professionals and users. Green building design is prone to failure in the absence of a close interaction and effective communication among project team members. Besides, gaps between interactions and decisions during the process of construction and management could also be a barrier (Stevenson and Rijal, 2010).

### 2.3 ORGANIZATIONAL AND PERSONAL BEHAVIORAL BARRIERS

There can be a general lack of incentives for investors to invest in green buildings. About one-third of surveyed companies in Hong Kong stated that the lack of incentives was the main barrier of engaging in voluntary environmental initiatives (Studer et al., 2006).

Some barriers may be created by an organization itself. Lack of environmental protection commitments from the administrative leaders, as well as inadequate communication between the stakeholder and administrators could create barriers to green building development (Richardson et al., 2007). Individuals' behavioral characteristics can also be barriers to green building development. Resistance to change was a barrier to implementation of energy efficiency measures (Nagesha and Balachandra, 2006).

### 3.0 POLICIES AND GOVERNANCE

There are several possibilities to promote green building development. On one hand market forces can be used, on the other hand a state control can take place. For example, governments have to formulate various policies to overcome its barriers, and to remove disincentives. Table 2 shows different types of policies that can be applied to overcome different types of barriers for different actors.

Barriers	Policy Instruments	Actors				
		1	2	3	4	5
Definition of Green Buildings	#Adoption of Green Building Labels	√	√	√	√	√
Funding Issues	#Grants and Loans	√	√	√		
Lack of Incentives	#Density Bonus	√	√			
	#Tax Credits	√	√	√		
	#Expedited Permit Process	√	√			
	*Eco Tax		√	√	√	
Split Incentives and Appropriability	#Regulation on Property Valuation	√	√	√	√	
	*Tenancy Law		√	√		
Lack of Knowledge and Awareness	#Performance Rating Disclosure System				√	
	#Mandatory Standards for Government Buildings	√	√	√	√	
	#Free Technical Advices	√	√	√		
	#Information on the Internet	√	√	√	√	√
	#Education and Training Programs					√
	*Green Building Audits		√	√		
	*Desktop Advices/Assistance		√	√		

† Targeted actors: 1. Developers, 2. Developer-Owners, 3. Individual Owners, 4. Tenant Users and 5. Contractors

#Policies for Green Building

\*Potential Policies that can be transformed from those targeted at Building Energy Efficiency.

TABLE 2: GREEN BUILDING POLICIES TARGETING DIFFERENT BARRIERS AND ACTORS

### 3.1 POLICIES TO OVERCOME THE BARRIER OF DEFINITION OF GREEN BUILDING

A proper definition of green building is needed when formulating green building policies. One way to resolve this is to introduce a green building label. Yet, the label should give a specific definition so that even laypeople can easily understand. In Germany with the rating systems DGNB and BNB approaches for the assessment and certification of sustainable buildings have been developed. These include not only definitions,

assessment criteria and benchmarks but also facilitate the communication between client and contractor as well as the planning and quality control.

### **3.2 POLICIES TO OVERCOME FUNDING ISSUES**

Loan relief and grants can be provided for developers to reduce the initial cost required for green buildings. Internationally, there are many examples of provision of subsidized financing and insurance in related to energy efficient, green and sustainable buildings. Under Los Angeles Department of Water and Power Green Building Incentive, a grant up to US\$250,000 would be awarded to buildings which met the LEED (Leadership in Energy and Environmental Design) standard. In Germany so far there are funding programs particularly for improving the energy performance, such the one supported by KfW Bank. Specifically, a report commissioned by WWF and E3G (Höhne et al., 2009) scored this “energy efficient buildings package” as the most successful policy with the most important green effects across a range of countries.

### **3.3 POLICIES TO OVERCOME LACK OF INCENTIVES**

Density bonus or height relaxation has sometimes been used as an incentive to encourage developers and developer-owners to invest in green buildings. Fulfilling the BEAM-Plus requirements was made as a pre-requisite for obtaining a density bonus in Hong Kong after 2011. In Germany, in some municipalities the allocation of land is subject to an obligation to construct energy-efficient buildings. Besides density bonus, taxation incentives can be used for promoting green building development. Tax credit has been employed in the US as a policy instrument to encourage more LEED certified buildings (DuBose et al., 2007). In Europe - including Germany - this issue has already been discussed - there are no concrete results yet.

With an expedited permit process, developers will have the incentive to make the building greener because they can enjoy a reduction in cost. The Green Permit Program in Chicago guaranteed an expedited permit of 30 days if the building was LEED certified.

### **3.4 POLICIES TO OVERCOME SPLIT INCENTIVES AND APPROPRIABILITY**

To overcome the barrier of split incentives and appropriability, the questions of whether and to what extent the benefits of energy-efficient, green or sustainable buildings are already reflected in the purchase price are of high importance. In Germany for example the energy-related quality of buildings is already taken into account according to the national regulation of valuation (Meister and Dressel, 2012).

### **3.5 POLICIES TO OVERCOME LACK OF KNOWLEDGE AND AWARENESS**

Sellers and landlords can be required to display building environmental performance certificate to potential homebuyers or renters so as to address the issue of imperfect information when making home purchase or rental decisions. Since 2006, Korea had implemented a Housing Performance Rating Disclosure System for the purposes of ascertaining quality supply of housing, while promoting an increase in the supply of ecologically friendly housing. In Germany, over the past few years an energy certificate with information related to energy performance has to be submitted to every tenant or buyer. In public buildings these energy certificates must be hung up clearly visible. In the future, information on the energy quality will become part of the advertisement for rent and sale of buildings in magazines and newspapers.

Governments should assume a leading role in promoting green buildings. In many countries, like US and Germany, it is mandatory for government buildings to meet certain green building criteria. Specifically in Germany every new federal building must achieve the quality level "SILVER" based on the national sustainability assessment system BNB.

Technical advices and assistance can be offered by governments or private organizations. Under the 2005 Ordinance in Oakland in the U.S., free technical assistance on green building development would be provided by the government to private sector. In Germany advising clients on matters concerning energy efficiency is financially supported. At the moment, programs are starting in individual municipalities to support the sustainability consulting and assessment in the construction of residential buildings (e.g. Hamburg). Furthermore, A lot of information is needed during the decision process of green building design / construction within a short time frame. To this end, internet has been considered to be one of the most effective channels to provide new information for green building design / construction (Thunselle et al., 2005). Via the Internet platform [www.nachhaltigesbauen.de](http://www.nachhaltigesbauen.de) all the basics and tools for sustainable construction in Germany are publicly available. This includes information on construction products, LCA data, the long-term durability of components, etc.

Educational and training programs can be organized for equipping building contractors or designers with the knowledge to develop green building solutions. In Germany, many universities offer master's programs for sustainable building. The organizations for architects and engineers incorporate the theme into their training programs. The public sector educates through special programs sustainability coordinators.

#### **4.0 POTENTIAL POLICIES (I.E. CAN BE TRANSFORMED FROM THOSE TARGETED AT BUILDING ENERGY EFFICIENCY)**

##### **4.1 ECO-TAX AND TENANCY LAW**

Following the approach in promoting building energy efficiency, imposition of an eco-tax on conventional buildings may indirectly encourage developers to make their building greener. Besides, the tenancy law for promoting energy efficiency may also be amended to allow homeowners to recover the additional costs required for making the building green. It helps overcome the barrier of split incentives. Landlords can be allowed to increase the rent until the costs of green building measures have been recovered in some cases - especially in the case of improving the energy quality of existing buildings.

##### **4.2 GREEN BUILDING AUDITS AND DESK ADVICES**

Similar to energy audit policy in Germany, green building audits are required for providing building owners with more information about the technologies that are currently available for improving the environmental performances of buildings, as well as the associated costs and benefits. When it comes to desk advices, building owners can seek technical and financial advices from governments or semi-governmental organizations. The costs for provision of advices can even be subsidized or free.

#### **5.0 UNRESOLVED ISSUES**

##### **5.1 RISK AND UNCERTAINTIES**

One of the hindrances for developers for undertaking green building developments is that they may not know if they can get their investments back. Hitherto, there is still no specific policy to deal with this issue. In Europe, however, discussions have begun about whether and to what extent the insurance companies can develop special products to cover the performance risk.

## **5.2 QUANTIFICATION OF BENEFITS**

Many research studies have been attempted to quantify the intangible benefits brought by green buildings. However, there still exist methodology gaps in quantifying the intangible benefits of green buildings, in particular with regard to the accuracy of quantitative extrapolations of the research studies (Fisk, 2000).

## **5.3 PROCESS-RELATED, ORGANIZATIONAL AND PERSONAL BARRIERS**

There are no specific policy instruments which dealt with process-related, as well as other organization and personal behavioral barriers. Even though legal standards could produce positive results (Easterbrook, 1995), they might lead to suboptimal outcomes (Tenbrunsel et al., 1997). Extensive educational campaigns are also needed (Hoffman and Henn, 2008). Therefore, it is important to train not only architects and engineers, but also real estate professionals and valuers. At the KIT in Karlsruhe, since 2000 a chair for the training of real estate specialists in the subject area of sustainable construction exists. This was supplemented in 2012 by a chair for the integration of sustainability into the valuation in cooperation with RICS.

## **6.0 CONCLUSION**

This paper identifies various barriers to green building development and the policies implemented to overcome some of these barriers. Some potential policies that can be transformed from those targeting at building energy efficiency to green buildings together with some unresolved barriers have also been discussed. It is hoped that more studies will be conducted in future so as to help policy makers to formulate policy instruments to overcome these unresolved barriers.

## **ACKNOWLEDGEMENTS**

The authors would like to thank the 2011/12 Germany/Hong Kong Joint Research Scheme for providing financial support by the Hong Kong University Grant Council and the German Exchange DAAD through Grant No G\_HK034/11.

## **REFERENCES**

DuBose , Jennifer R., Bosch, Sheila J., Pearce, Annie R., 2007. Analysis of State-Wide Green Building Policies. *Journal of Green Building*, 2(2), 161-77.

Easterbrook, G., 1995. *A moment on the earth*. New York: Viking.

Erlandsson, M., Generic M.B., 2003. LCA-methodology applicable for buildings, constructions and operation services-today practice and development needs. *Building and Environment*, 38, 919–38.

European Commission, 2013. *Energy performance certificates in buildings and their impact on transaction prices and rents in selected EU-countries, final report*

Fisk, William J., 2000. Health and Productivity Gains from Better Indoor Environments and their Relationship with Building Energy Efficiency. *Annual Review of Energy and the Environment*, 25, 537-66.

Höhne, N., Burck, J., Eisbrenner, K., Vieweg, M., Gießhaber, L. 2009. Scorecards on best and worst policies for a green new deal, Ecofys and Germanwatch, WWF and E3G, 8-9

Issa, M.H., Rankin, J.H., Christian, A.J., 2010. Canadian practitioners' perception of research work investigating the cost premiums, long-term costs and health and productivity benefits of green buildings. *Building and Environment*, 45, 1698-1711.

Meister, D. and Dressel, K., 2012. Valuation of Real Estate in Germany. In Just, T. and Maennig, W. (eds.), *Understanding German Real Estate Markets*, Management for Professionals, Springer-Verlag Berlin, Heidelberg

Nagesha, N., Balachandra, P., 2006. Barriers to energy efficiency in small industry clusters: multi-criteria-based prioritization using the analytic hierarchy process. *Energy* 31, 12 1969-83.

Richardson , Gregory R.A., Lynes, Jennifer K., 2007. Institutional motivations and barriers to the construction of green buildings on campus: A case study of the University of Waterloo, Ontario. *International Journal of Sustainability in Higher Education*, 8(3), 339-54.

Samari, M., Ghodrati, N., Esmailifar , R., , Olfat, P., Mohd Shafiei, M.W.. The Investigation of the Barriers in Developing Green Building in Malaysia, *Modern Applied Science* (2013), 7(2), 1-10.

Schweber L., 2013The effect of BREEAM on clients and construction professionals. *Building Research and Information*, 41(2), 129-45.

Stevenson, F. and Hom, B.R., 2010. Developing occupancy feedback from a prototype to improve housing production. *Building Research & Information*, 38(5), 549-63.

Studer, S., Welford, R., Hills, P., 2006.Engaging Hong Kong Businesses in Environmental Change: Drivers and Barriers. *Business Strategy and the Environment*, 15, 416-31.

Tenbrunsel, A., Wade-Benzoni, K., Messick, D., & Bazerman, M., 1997. The dysfunctional effects of standards on environmental attitudes and choices. In M.

Bazerman, D. Messick, A. Tenbrunsel, & K. Wade-Benzoni (Eds.), *Psychological perspectives to environmental and ethical issues*. New Lexington Books, San Francisco.

Thunselle, K., Erhorn Kluttig, H., Mørck, O., Ferrari, S., Fuentes, M., Jicha, M., Kaklauskas, A., Kauppinen, T., Triantis, E., 2005. Bringing Retrofit Innovation to Application in Public Buildings – BRITA in PuBs. Deliverable D5 - Socio-economic Analysis on Barriers and Needs.