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ABSTRACT

Green building (GB) policies have been implemented to promote GB and address climate change. Most of the existing literatures have studied the costs and benefits of developing GB, without considerations of GB policies' impacts. This paper aims to study costs and benefits of implementing GB policy from developers' perspective. It takes the Gross Floor Area (GFA) Concession, which is a popular policy and has been implemented in the US, Singapore and Hong Kong, as an example, to compare its implementation in three regions and analyze how it affects developers' costs and benefits. Findings show that Hong Kong has relatively lower threshold to acquire GFA concession for developers and it is the right time to adjust the GFA concession incentive to reflect the market transformation and further encourage developers to go for higher levels of GB.

Keywords: *policy and regulation, costs and benefits, GFA concession*

1. INTRODUCTION

Building energy consumption contributes to one-third of greenhouse gas emissions in the world (UNEP, 2009). Besides, building sectors also affect the built environment in other ways, like environmental damage, resource depletion and solid waste generation in the process of building construction and operation. Against this background, green building (GB) as a solution to the environmental problems become popular. However, constructing green building costs more than traditional buildings, which is one of the main barriers to prevent GB development. To promote the GB, various economic incentives have been implemented to reduce or cover developers extra costs, such as GFA concession, tax reduction, and subsidies.

Among all these economic incentives, the GFA Concession Scheme becomes a popular one because it would not affect government income and be subject to government financial situations (Fan, Qian, & Chan, 2015). The GFA Concession Scheme is designed to reward developers extra GFA for their contributions to the public facilities or sustainability and government could save that amount of money in the meanwhile. However, too many GFA concessions would impose additional social costs (Feiock, Tavares, & Lubell, 2008), and few GFA concessions are not enough to motivate developers to construct different levels of green building. Therefore, how to use this instrument to promote GB remains a question. This paper studies the GFA Concession Scheme in the US, Singapore, and Hong Kong and analyzed how the scheme affect developers' costs and benefits and how to adjust it to reflect market transformation of GB.

2. COSTS AND BENEFITS TO CONSTRUCT GREEN BUILDING

The additional costs of green building have been discussed in a lot of articles. For example, Yu and Tu (2011) stated that Green Mark buildings require a range of 1%-3% extra cost compared with non-green mark buildings in Singapore. Their Building and Construction Authority (2015) stated that the cost premiums for GM Platinum, and GoldPlus are S$123/m2 and S$97$/m2 in the residential sector. Kats et al. (2003) claimed 0.66% extra cost for LEED certification, 2.11% for Silver, 1.82% for Gold, and 6.50% for Platinum in the US. Davis Langdon (2007) suggested 3%-5% greater cost for five-star and 6% for six-star in Australia where the Green Star rating system is employed. In Hong Kong, under the Hong Kong Building Environmental Assessment Methods (BEAM), there were 0.8%, 1.3% and 3.2% cost premiums for Silver, Gold and Platinum building respectively (Burnett et al., 2008). However, the HKBEAM has been upgraded to BEAM Plus and experienced two versions for new buildings and three versions for existing buildings. The construction cost of green building has increased with the upgradation of the BEAM Plus. Similar situation also happened in the US. The improvement of the LEED increased the construction costs of green building, which in return influences the updates of the green building incentive.

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In terms of financial benefits to construct green building, Fuerst and McAllister (2008) claimed that green buildings have price premiums, 10% and 31% premiums for GB certified by Energy Star and LEED respectively. Yu and Tu (2011) stated that Green Mark buildings have a price premium that increases with the rating of Green Mark. Miller, Spivey, and Florance (2008) suggested 9.94% price premium for LEED and 5.76% for Energy Star per square foot. However, there are few studies discussing the selling price of GB in Hong Kong. The most relevant one finished by Burnett et al. (2008) studied the financial benefit of GB from the life cycle's perspective, such as reducing sewage charges and energy consumption.

3. Green building incentive schemes

In order to promote green building, customized incentive schemes are acknowledged as one of the most effective approaches for government intervention (Qian & Chan, 2007). Their purpose is to motivate the market and attract the stakeholders' business interests in green building investment through reasonable incentive policies. To fulfill this objective, the incentives should be attractive to business and also be administratively easy for government to implement. The main reasons for instituting incentives for GB promotion are: 1) To correct for external costs; 2) To supply information (when the incentive is tied to a specific action or investment); 3) To reduce investor risk in a new technology; and 4) To accelerate the pace of adoption of efficient technologies.

3.1. The GFA Concession Scheme and developers' costs and benefits

The GFA Concession Scheme is designed to reward developer additional gross floor area for their contributions to the public facilities so that government could save money to invest (Tang & Tang, 1999). It has a long history and been applied to renewable energy of buildings in New Zealand, Japan, France and US (Paetz & Pinto-Delas, 2007), affordable housing incentive scheme in the US, Australia and UK (Fox & Davis, 1975), and green building promotion in the US, Singapore and Hong Kong (Fan, Qian, & Chan, 2015) where different terminologies sharing the same meaning, such as density bonus, GFA concession and GFA bonus, are used. The GFA Concession Scheme addresses the market barriers of higher upfront cost and corrects the misplaced incentives of green building.

3.1.1. US

The Arlington County is the first one to implement the GFA bonus in the US. It started in 1999, and was revised in 2003, 2009, 2012 and 2015 on the basis of the increase in knowledge and market demand for green buildings.

Table 1 illustrates the development history of the GFA bonus incentive scheme in Arlington County. The adjustment of the GFA bonus incentive is based on the market transformation that buildings achieved lower levels of LEED more frequently. Obviously, the assessment criteria and the calculation method of the GFA bonus were becoming more difficult and complicated from 1991 to 2015. The Table 1 indicates that to reflect the market transformation, the adjustment of GFA bonus could start from four aspects: 1) to expand the range of GFA bonus; 2) to reduce the level of GFA bonus; 3) to improve the criteria to acquire GFA bonus by upgrading the green building assessment methods, and adding additional conditions (like energy efficiency): 4) to increase GFA bonus for meeting higher rating of GB or additional conditions, and decrease bonus for lower ratings. From 2009, the incentive for office buildings is separated from and less than that for residential buildings in that office buildings have more market demand. Government incentives were given more to the residential sector. From 2012, the energy efficiency requirement was added in the incentive scheme to further promote sustainability. In 2015, Energy Star certification becomes mandatory to apply for the GFA bonus for the office buildings. Every time to adjust the incentive, developers' costs and benefits were considered. For example, LEED version 4 leads to more construction cost than LEED 2009 and Energy Star certification also costs developers. Therefore, in 2015, the incentive level increases a little to motivate developers to adopt new standards.

3.1.2. Singapore

The Building and Construction Authority (BCA) in Singapore and the Urban Redevelopment Authority (URA) jointly released the Green Mark (GM) GFA Incentive in 2009, which stated that developers and building owners could apply for up to 2% GFA bonus (subject to a cap of 5,000 sqm) in exchange for constructing GM Goldplus building and 1% GFA bonus (subject to a cap of 2,500 sqm) for constructing GM Platinum buildings. During 2009-2013,

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the total GFA of green buildings increased 34.2 million m2, while before this GFA scheme, the increased total GFA of green buildings only increased 14.2 million m2 within 4 years from 2005 to 2009.

In 2010, BCA announced that under government land sale program, all the new developments on the land sold on or after 5 May 2010 in the Strategic Growth Areas should be designed to meet a higher GM certification (Building and Construction Authority, 2014). In Downtown core, it is required that building should reach GM Goldplus Rating. This policy could help improve building energy efficiency and release heat island effect in city core. Therefore, it is mandatory to construct green building in the Downtown core.

	1999	2003	2009	2012	2015	
Objective	To guide the building design and construction	To include all LEED levels and all the projects	To adjust the bonus to reflect market transformation	To focus on energy efficiency to align with the Community Plan goals, minor bonus adjustment	To encourage developers focusing on the incorporation of energy efficiency into the site plan and on the ongoing energy consumption	
Assessment criteria	• LEED Silver only (commercial office only)	• LEED Certified, Silver, Gold or Platinum	• LEED Certified, Silver, Gold or Platinum	• LEED 2009 Silver, Gold or Platinum • Energy efficiency for commercial office buildings	• LEED version 4 • Energy Star Building certification within four years of occupancy (commercial office building) • Community Priority credits (optional)	
Calculation of GFA concession	• Up to 0.25 FAR (floor area ratio)	• 0.15FAR (Certified) • 0.25FAR (Silver) • 0.35FAR (Gold) • 0.35FAR (Platinum)	**For office buildings** • 0.05FAR (Certified) • 0.15FAR (Silver) • 0.35FAR (Gold) • 0.45FAR (Platinum) **For residential buildings** • 0.10FAR (Certified) • 0.20FAR (Silver) • 0.40FAR (Gold) • 0.50FAR (Platinum)	**For office buildings** • 0.20 FAR (Silver+20% energy efficiency) • 0.35FAR (Gold+20% energy efficiency) • 0.45FAR (Platinum+20% energy efficiency) **For residential buildings** • 0.25 FAR (Silver) • 0.40FAR (Gold) • 0.50FAR (Platinum) **Multifamily residential buildings** • Additional 0.05FAR (LEED +18% energy efficiency	**For office buildings** **Silver** • 0.25 FAR (Energy Star score of 75) • 0.275 FAR (Energy Star score of 75+ one Community Priority credit) • 0.30 FAR (Energy Star score of 75+ Two Community Priority credits) **Gold** • 0.35FAR (Energy Star score of 75) • 0.375 FAR (Energy Star score of 75+ one Community Priority credit) • 0.40FAR (Energy Star score of 75+ two Community Priority credits) **Platinum** • 0.50FAR (Energy Star score of 75) • 0.525FAR (Energy Star score of 75+ one Community Priority credit) • 0.55FAR (Energy Star score of 75+ two Community Priority credits)	**For residential buildings** **Silver** • 0.25 FAR • 0.275 FAR (one Community Priority credit) • 0.30 FAR (Two Community Priority credits) **Gold** • 0.35FAR • 0.375 FAR (one Community Priority credit) • 0.40FAR (Two Community Priority credits) **Platinum** • 0.50 FAR • 0.525 FAR (one Community Priority credit) • 0.55 FAR (Two Community Priority credits) LEED Gold plus Two Community Priority credits plus Net Zero Energy certification may earn extra density bonus above 0.55 FAR

Table 1: The GFA bonus scheme in the US Source: Arlington County Government (2016), Chris Cheatham (2009), Arlington County Government (2014), Office of Sustainability and Environmental Management (2013)

3.1.3. Hong Kong

Hong Kong has implemented the GFA Concession Scheme since 2011, which grants developers GFA concession if they register the BEAM Plus or reach any level of BEAM Plus, fulfill the Sustainable Building Design Guidelines (SBDGs) and provide the prescribed building features. The floor areas of these building features they designed could be exempted from the calculation of the GFA. The prescribed building features are tailored for the specific built environment in Hong Kong to address the urgent city problems. To some extent, it is mandatory to integrate the features in order to applying for the GFA concession. For Hong Kong government, few construction costs of these building features could improve the built environment. However, for the developers and architects, design the building features and get approval from government takes time and involve approval risks, especially at the beginning of implementing the GFA Concession Scheme. With the practice of participating the scheme, industry is becoming more and more familiar with the SBDGs. The Figure 1 illustrates the statistics of applications for the GFA concession from 2011 to 2014. It is obvious that there are more and more applications and the approval rate is becoming high. This reflects the market transformation that developers could benefit from the participating the GFA Concession Scheme, and the knowledge and market demand for green buildings have increased.

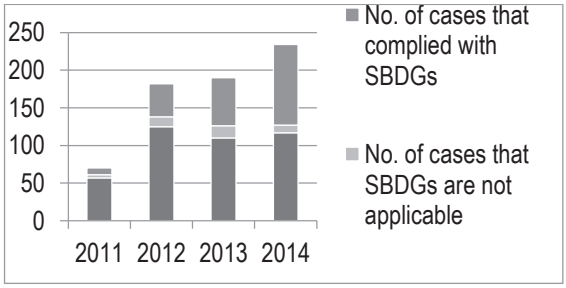

Figure 1: Statistics of applications for the GFA concession Source: Building Department (2014)

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3.1.4. Comparison of US, Hong Kong and Singapore

US have longer history of GFA concession incentive to promote green building than Hong Kong and Singapore. It has developed criteria to assess market transformation of green building and detailed methods to adjust the GFA bonus with the market transformation, which has been illustrated in previous section. On the contrast, Hong Kong and Singapore are experiencing the period of trial and error. It takes time to understand how market works and improve the incentive scheme, especially for the construction industry with several years' construction period. Besides, unlike Hong Kong and Singapore, the Arlington County have not considered too much about local built environment. It may be because Hong Kong and Singapore has high development density and land price. The amount of GFA bonus and how to grant it would influence market and built environment more.

Hong Kong and Singapore have integrated GFA concession incentive scheme into the development control system in a different way. In Hong Kong, GFA concession is subject to the floor area of certain building features illustrated in the Building Ordinance. And the BEAM Plus and SBDG are the prerequisites of being granted GFA concession. Only obtaining the BEAM Plus certification and fulfilling the SBDG are not enough to be granted GFA concession. In Singapore, GM Platinum or Goldplus is the only requirement of getting GFA bonus. However, in the new growth strategic areas, it's mandatory to achieve GM Platinum or Goldplus because they are the land sale conditions. This indicates that, when Singapore government made Master Plan, they already made the plan of GB distribution.

There are different methods to calculate GFA concession in Hong Kong and Singapore as showed in the Table 2, which is closely related to the development control. In Singapore, GM GFA is relevant to land value, total GFA regulated in Master Plan and the prescribed green premium. As the prescribed green premium increases with the rating of GM, and further increase the GM GFA bonus that means more salable area, developers are motivated to construct higher ratings of GM. The land value and total permitted GFA are fixed and could be estimated, which reduce the risks to participate the GM GFA Incentive Scheme for developers in Singapore. On the contrast, in Hong Kong, most of the land value is determined by land auction and how many GFA concession developers could acquire is uncertain, bringing more uncertainties to developers. Additionally, not all the exempted floor area could be salable area. It depends on the property market and economic situations. Therefore, under the current systems, developers in Singapore have fewer risks than those in Hong Kong if they participate in the GFA Concession Scheme. In other words, the system in Singapore costs developers less.

On the other hands, the threshold (minimum standard to grant GFA concession) to participate in the GFA Concession Scheme in Hong Kong is lower than that in Singapore (Table 2). Developers only need to register the BEAM Plus that costs them much less than reaching the higher ratings of GB. This little extra cost can help them acquire the GFA concession and make profits from it. That is why after implementing the GFA Concession Scheme, the registered BEAM Plus projects have increased almost one third within one year (Liu & Lau, 2013). Moreover, developers in Hong Kong do not have to provide security deposit like Singapore to guarantee that they would achieve the certain rating of BEAM Plus they committed they apply for the GFA concession. This largely decreases the investment risks for developers. However, with the increase in GB knowledge and market demand, it is the time to adjust the incentives to reflect the market transformation.

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	Hong Kong **Gross Floor Area concession (since 2011)**	**Singapore** **Green Mark Gross Floor Area incentive scheme (Since 2009)**
Objective	To attract developers to construct BEAM Plus building and integrate sustainable building design guideline (SBDG)	To encourage the private sector to develop buildings that attain higher tier Green Mark ratings (i.e. Green Mark Platinum or Green Mark Gold PLUS)
Assessment criteria	• BEAM Plus Registration (Prerequisite) • Sustainable building design guideline (Prerequisite) • Building features illustrated in the Joint Practice Notes (e.g. green features, amenity features.)	• Green Mark Platinum could be awarded 2 % GFA bonus at most (subject to a cap of 5,000 sqm). • Green Mark Gold plus could be awarded 1% GFA bonus at most (subject to a cap of 25,000 sqm)
Calculation of GFA concession	GFA Concession = Exempted GFA + Disregarded GFA + GFA bonus	$GM\ GFA = \frac{[\text{Proposed GFA (sqm) (subject to MP allowable intensity)}] \times [\text{Prescribed Green Premium (\$/sqm)}]}{\text{Land Value (\$/sqm) (determined by proxy using DC rates)}}$
Mandatory / Voluntary basis	• Voluntary to participate in GFA concession incentive scheme; • Mandatory to acquire BEAM Plus certification and fulfill SBDG if developers want all the building features granted GFA concession	• Voluntary for new private development (non-public sector), redevelopments and reconstruction developments to join the scheme; • For the sites where the GM Platinum or Goldplus standards are mandated as part of land sales condition, it's mandatory to reach GM Platinum or Goldplus without GFA bonus. • For the sites where the Goldplus standard is mandated, it's voluntary for developers to attain the higher GM Platinum standard and acquire an incremental GFA incentive (the difference between GFA incentives for GM Platinum and GM Goldplus).
Enforcement	NA	• Security deposit to guarantee that developers achieve the GB grading they committed
Minimum standard to grant GFA concession	• BEAM Plus registration • Provision of prescribed green features • Fulfilling the SBDGs	• GM Gold Plus

Table 2: Comparison of the GFA concession scheme in Hong Kong and Singapore

4. DISCUSSION AND CONCLUSION

This paper discussed how the GFA Concession Scheme affects the costs and benefits of developers. The amount of the GFA concession and calculation method, minimum standard to grant GFA concession, as well as the costs to fulfil different GB assessment system influence developers' costs and benefits. Hong Kong has relatively lower threshold to apply for the GFA concession, compared with Arlington, US and Singapore, mainly because the BEAM Plus requirement to qualify for the GFA concessions is simply to register the projects, which means that buildings do not get certifications and only need to fulfil the prerequisite in each section of the BEAM Plus which costs developers little. After 5 years of implementing the GFA Concession Scheme, there are 66% (860 out of 1312) projects have registered BEAM Plus, and 21% (270 out of 1312) projects have achieved Provisional Bronze or above (Building Department, 2014). It is the right time to adjust the scheme to encourage developers to go for higher levels of GB.

Borrowing the experience from Arlington County, the adjustment of the GFA Concession Scheme could start from three aspects: 1) the prerequisite that register the BEAM Plus should increase to the BEAM Plus Provisional Bronze; 2) grant different levels of BEAM Plus buildings different amount of the GFA concession on the basis of the extra construction costs; 3) give more GFA concessions to the higher levels of GB (like Gold and Platinum).

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