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The Constrains of Green Building Implementation in Indonesia

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Abstract. Various success evidence of green building to save energy usage and reduce environmental impacts has been widely shared in various scientific and popular media. The information is not merely theoretical but also practical, include information about the addition of investment value, savings and profit earned on the operation stage. The government and the private sector have also encouraged the acceleration of its implementation through the establishment of regulations and rating tools that accomodate responsibility for property industry actors to participate in implementing green building concepts. This study aims to find out the obstacles of green building implementation in Indonesia through literature review, policy review and also interviews to stake holders. Apparently, efforts are still needed to complete the various regulations needed for stakeholders to implement the concept of green buildings in all parts of the building's life cycle.

1. Introduction

The issue of environmentally friendly development has been discussed for more than three decades, but to date efforts to reduce environmental damage and energy consumption remain unresolved. CO₂ emissions, as an indicator of environmental damage, continue to increase from year to year. Globally [1] in 2013 CO₂ emissions were recorded at 32.2 Gt, an increase of 2.2% from 2012. Energy consumption also showed an increasing trend, in 2014 world energy consumption had doubled 3.5 times compared to 1965 [2]. Fossil energy still dominates despite an increase in nuclear and other renewable energy. Data from the National Energy Council [3] states that total energy consumption in Indonesia in 2014 amounted to 1.415 Million BOE (Barrels of Oils Equivalent) or an average increase of 4.9% per year, and from that amount the largest consumption was oil by 48% followed by coal 31% and gas 17.2%. Data from the International Energy Agency in 2014 also showed that the current available electricity supply is still largely produced from fossil fuels, namely coal and natural gas, for example in the USA, 67% of electricity supply is produced from fossil energy and natural gas.

In the building sector, the issue of eco-building or green building or environmentally friendly buildings has emerged since the 1970s [4,5]. Some building designs are inspired by the ideas of Victor Olgay (Design with Climate), Ralph Knowles (Form and Stability) and Rachel Spring (Silent Spring), for example in 1977 Norman Foster tried to apply grass roof, daylighted atrium, and mirrored windows on Willis building Faber and Dumas Headquarter in England. Although the seeds of green building have long emerged, in fact efforts to reduce environmental damage and energy consumption, especially non-renewable energy, are still constrained. In America for example, the building sector is



still the largest consumer of energy users and most of the energy is used for the purposes of room conditioning. The building sector is also one of the biggest contributors to CO₂ emissions [6]

One of the causes of the still widespread issue of environmental damage and energy consumption is the incomprehension of the principles and criteria of green buildings. Some actors in the building industry, including architects, are still trapped in practical matters, such as using an inefficient air conditioning equipment (AC) but forgetting essential things such as building design (form, orientation, envelope, layout) which will significantly affect the performance of buildings in energy savings and environmental impact reduction. It is feared that such limited understanding can obscure the essence of environmentally friendly buildings. An efficient mechanical and electrical equipment (active strategy) is indeed needed in buildings as well as good material specifications but both of these can be optimized if preceded by planning and designing the shape, orientation, spatial layout and elements of the building envelope (passive strategy) right.

Another thing that is also often misunderstood is an understanding of environmentally friendly buildings that are often mixed with human-friendly buildings. Practitioners try to provide a comfortable environment for residents of the building but unconsciously these efforts can damage the environmental conditions outside the building. The use of air conditioning equipment to cool the room can have a direct impact on the heating of the outside environment. For this reason, serious consideration must be given to the design process of the building and its interior space so that the option to use air conditioners is an additional option if natural ventilation is not possible. Likewise, it is necessary to consider which rooms require air conditioning and which spaces require only natural ventilation. Efforts to design a comfortable space for humans must be directly accompanied by consideration and efforts not to damage the environment.

Efforts to expand the implementation of environmentally friendly buildings are carried out by the government and non-governmental organizations. One example of a country that is consistent in its efforts to implement environmentally friendly buildings is Singapore. At the end of September 2013 (approximately 8 years since it began in 2005) a total of 1696 buildings were certified or approaching 50 million m² of building floor area. BCA (Building Construction Authority) as the authority in charge of regulating buildings in Singapore targets the achievement of 80% of green building certification from all buildings in Singapore by 2030 [7]. Singapore's persistence in applying the concept of green to buildings should be an example for other countries.

The Indonesian government has also sought to encourage the implementation of the green concept in buildings as part of the government's promise to the world to reduce CO₂ emissions and greenhouse gases. In order to follow up on the Bali Action Plan at the 13th Conferences of Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC), the results of COP-15 in Copenhagen and COP-16 in Cancun and fulfill commitments at the G-20 meeting in Pittsburg. The Government has established Presidential Regulation N0. 61 of 2011 which contains the government's commitment to reduce CO₂ and greenhouse gas emissions by 26% by 2020. The government represented by the Governor of DKI Jakarta has also promised to reduce CO₂ and greenhouse gas emissions at the C40 Cities Climate Leadership Group in Seoul, Korea 2009. In addition, the Government of Indonesia has also established several specific regulations governing environmentally friendly buildings or green buildings, including: Permen LH No.8 / 2010 concerning Criteria and Certification of Green Buildings, DKI Jakarta Governor Regulation No.38 year 2012 concerning Green Building, Minister of Public Works and Public Housing Regulation No.02 / PRT / M / 2015 concerning Green Building, Bandung Mayor Regulation No.1023 of 2016 concerning Green Building.

In addition to the government, a non-governmental organization, the Green Building Council Indonesia (GBCI), or the Indonesian Green Building Council, also attempting to expand the implementation of green buildings. GBCI is a non-profit institution established in 2009 supported by practitioners, government, industry, academia and professional associations. GBCI is committed in the field of community education to applying environmental practices and facilitating the transformation of a sustainable building industry. In June 2010, GBCI, which is a member of the World Green Building Council (WGBC), adopted the Greenship Rating Tools as a tool or reference for determining

green ratings for buildings in Indonesia. The Greenship Rating Tools apply voluntary, meaning that there is no requirement for every building in the territory of Indonesia to follow these guidelines.

The immediate benefit of implementing the green building concept is the production of high-performance buildings in reducing energy consumption and reducing the impact on the environment. Reports from the USGBC (United States Green Building Council) in November and December 2002 stated that the implementation of the green concept in buildings would save operational energy use by an average of 28% of conventional buildings, not including savings on the use of renewable energy. Another report from the BCA (Building Construction Authority) Singapore entitled 'Leading the Way for Green Buildings in the Tropics' in 2015 states that the implementation of the green concept in buildings can save energy consumption between 30% to 80% by utilizing the available current technology.

The Kats report [8] on costs and financial benefits of implementing green buildings actually proves that the cost of designing and constructing green buildings, especially in California, is only around 2% higher than ordinary buildings, but the financial benefits are actually greater than the additional costs, both in the form of energy savings, water savings, waste management savings, savings in operational and maintenance costs, increased productivity and improving the health conditions of its users. This report also invalidates the view that believes that green buildings are expensive and require large additional costs compared to ordinary buildings. Kats also added that, the additional costs associated with the implementation of the green building concept are calculated to break even by the benefits in just 2 to 3 years, and then within a period of 15 years, the financial benefits will reach 10 times compared to the additional costs.

Until June 2019, or about 7 years after the Jakarta's governor regulation on green buildings was established, a total of 392 buildings or approximately 25 million m² of building area has met the minimum criteria of green buildings stipulated in the regulation. That achievement is still far compared to Singapore's achievement. For this reason, it is important to know the obstacles encountered by stake holders in their efforts to apply the concept of green buildings.

2. Methodology

To find out the constrains of green buildings implementation in Indonesia, this research use a literature review, a policy review and interviews with green building stake holders. The literature review is carried out to determine all factors associated with the implementation of green buildings. The policy review is carried out through tracking regulations related to the implementation of green buildings that have been established so far by the government. This review aims to determine the suitability and completeness of the regulations needed to support the implementation of green buildings in Indonesia. While interviews were conducted to find out the obstacles faced by stakeholders in implementing the concept of green buildings.

3. Results and Discussion

William [9] emphasized that green design utilizes environmentally sensitive materials, creating a healthy environment that does not have a negative impact either before, during or after the manufacturing, construction and demolition processes. This needs to be emphasized because designs that have considered the concept of green will be useless if the process of making the material (building materials), the process of development, the process of utilization, and the process of destruction do not consider the concept of green as well. The concept of green covers the entire life cycle of the project from the idea to the demolition. According to Wonoraharjo [10] there are 3 main things that should be considered in the green building concept (Figure 1), namely: efforts to minimize the environmental impact on the whole building life stages; energy conservation efforts on the whole building life stages; efforts to pay attention to human comfort and health

The maximum possible reduction of the impact on the environment can be done from the design process to the utilization process [11]. This can be started by making the design process a holistic thinking process [12]. If we want to change a product, one of the step options we can do is change the

design process, for example collaborating with various disciplines starting from the beginning to the end of the design process so that the product produced is an optimization of various considerations. The building design process is no longer a linear process from the architect forwarded to the structural expert and then continued to the mechanical, electrical and plumbing experts but the process of intensive and interactive discussion between various disciplines from concept to detail. The next option is to change the way of thinking for example by making the environment as a subject and not an object so that its interests can remain a priority or not make the environment an 'enemy' for the building but instead make the environment a 'friend' by utilizing its potential to minimize its threats. Sunlight is utilized as optimal as possible as a source of natural light and is pushed over the heat to reduce the heating of buildings or even heat used by converting it into electrical energy. Likewise utilizing wind for natural ventilation and reducing the heat or dust that goes with it or reducing the pressure so that it remains within the threshold of comfort. Efforts to minimize the impact of buildings on the environment can also be done by selecting the material by considering its availability in nature and the subsequent impact if the material is used up. Materials that are difficult to obtain from nature are in a place to be restricted in their use and materials that have been proven to have adverse effects on the health of their inhabitants should not be reused [11].

The construction stage is part of the building life cycle that is considered important by the construction industry players because this stage is directly related to the amount of investment. The general consideration used at this stage is saving investment costs and not environmental considerations. Environmental considerations at this stage raise the issue of a fairly high increase in investment costs even though the reality does not occur as previously described [8]. The increase in investment costs that only ranged from 2% to 6% [13] is not even significant when compared to the benefits gained during the operational period in the form of savings in energy use and reduction of environmental impacts as well as increased comfort and health for its residents. In principle, efforts to minimize environmental impacts at the construction stage are carried out by designing appropriate construction methods so as to minimize damage or balance to existing ecosystems and reduce air pollution in the form of dust or CO₂ emissions [14]. In addition to planning construction methods other efforts that can be done are to help reduce activities that require non-renewable materials, use recycled materials and use energy and other mineral sources to a minimum [15]. Some factors which are considered to hamper efforts to minimize environmental impacts at the construction stage are a lack of knowledge, a lack of firmness in implementing regulations and have not yet embraced the application of this understanding [11].

The process of utilization (operational) often escapes the attention of construction industry players, one of which is because the burden of building operating costs is no longer their responsibility and is borne by building users. Even though the operational period is a long period (decades) compared with building age, most of the conditions that occur at this stage are a direct result of the two previous stages, namely the design and construction stages. If the design and construction process has taken the form of as much as possible to reduce the environmental impact, then this process is just to enjoy the results. However, there are still some things that can be done especially by residents to increase the performance of reducing the impact on the environment, namely by reducing the amount of waste produced every day.

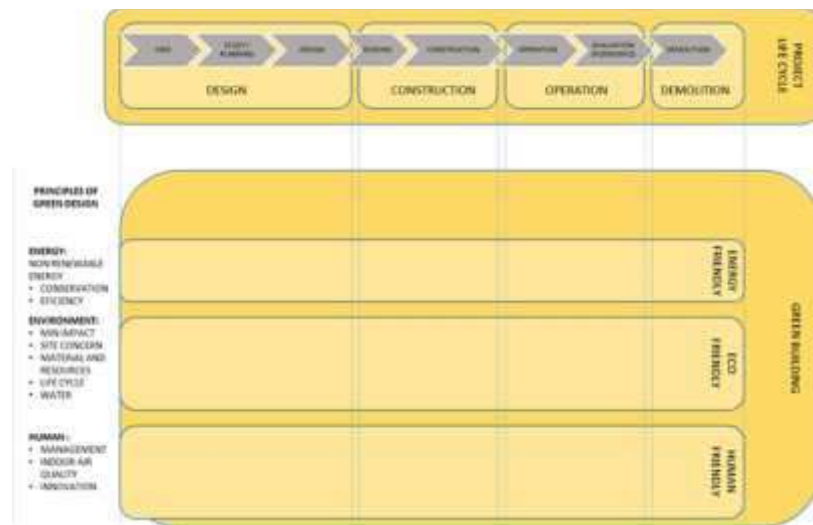


Figure 1. Green Building Scheme

Although every space conditioning (heating, ventilating, air conditioning) activity requires energy, there are several strategies to minimize energy requirements or optimize energy use [16]. Various energy utilization strategies can be seen in Figure 2. The designer can play a large role in the strategy of minimizing energy requirements by utilizing his competence in designing the shape, orientation and envelope of buildings. To minimize energy requirements, buildings in tropical climates are designed to avoid direct heating and even if heating has occurred, what is needed is to cool the building with evaporative, convective and conductive methods. Another thing that can be done is to use the wind to cross ventilate the building by flowing hot air out of the building and using the sun's light for lighting the room as long as possible.

The construction phase is often considered not to use much energy because the implementation time is relatively short compared to the operational period of the building. Nevertheless, savings during the construction period are still needed by determining the right construction method and using energy as needed.

Related to the use of energy in buildings, Sarte [14] proposed two efforts that could be made. First, by reducing energy requirements through building designs that make maximum use of the conditions outside the building for the sake of room conditioning. Second, if the first effort has been optimally done then what needs to be done then is to use energy as efficiently as possible for example by choosing energy-efficient equipment or using additional equipment such as sensors that can help the process of saving energy automatically. The next step is to look for technology options that allow CO₂ emissions reduction as well as renewable energy source options that allow for partial or full replacement of building energy use. Technically, efforts to reduce building energy requirements can begin with an appropriate site analysis, clearly defining project needs and objectives and matching energy availability on site [14]. Because each site is unique, the designer's job is to find and choose the most suitable energy application so that buildings can be produced that are in harmony with their environment, can respond to environmental demands and provide added value in the form of more comfort and inspiration for residents.

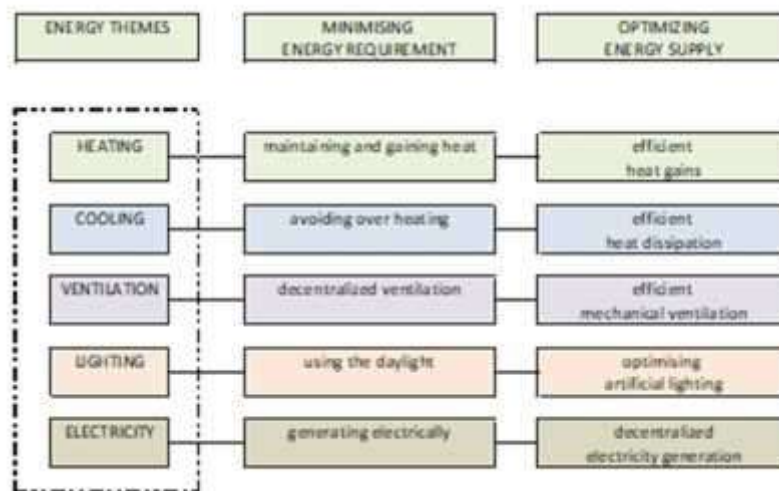


Figure 2. Energy Usage Strategy

Source: HeggerdanZeimer (2008): Energy Manual

Human relations and the environment is a unique relationship. In one condition, humans are part of the environment so efforts to reduce the impact on the environment also apply to humans. But at the same time, humans can also position themselves as entities outside the environment because of the ability they have to change the 'environment' as they wish. Human desire to change the environment around them to be comfortable and healthy for example in certain conditions has the potential to damage the environment. The activities of cutting down trees and leveling the land for shelter, making gardens or rice fields, making wells, making roads and so on are part of human efforts to fulfill their desires and this has the potential to damage the environment.

Humans also try to get comfort while in the building. In tropical climates, most of the energy is used to cool the room, while in subtropical countries most of the energy is spent on heating the room by using air conditioning systems. In tropical climates, for example, this system will cool the room and throw hot air out of the room or building. Consciously or not, it reflects the willingness of humans to sacrifice the environment outside the building in order to get comfort inside the building.

One option to still get comfort without compromising the environment or damage the environment as little as possible is to utilize natural air and lighting. A building can be designed by considering the use of natural air and lighting until a time when the expected conditions cannot be met, so it is forced to use mechanical or electrical equipment.

Human comfort is not merely a physical condition but is related to intermediary conditions such as clothes worn and also physiological conditions, such as gender and age [16]. Further physical conditions can consist of thermal conditions (heat), namely: temperature, humidity, air movement; visual condition (vision), namely: contrast, glare, color; acoustic / audial (hearing) conditions, namely: frequency, power level (noise); olfactory conditions (smell), namely: odor, CO₂, dust; other conditions, namely air pressure

Hegger and Zeimer's opinion about comfort is in line with Bougdah and Stephen [17] which states that comfort is a state of mind that is obtained from the physical condition of the environment, the ability of humans to control, and other physiological conditions. Humans as part of the environment also emit and absorb heat. The heat emitted by humans depends on the activity, body size and age, while the heat absorbed depends on the type of clothing worn and sex [17].

Regarding visual conditions, there are three factors that influence the quality of sunlight in a room [18], namely how large the size of the room, how the existence of the barrier and the choice of lighting technology installed in the building facade. A room is declared to have good visual quality if the bright conditions inside the building are the same as the conditions outside so that it is sufficient to carry out

activities inside; sunlight in space evenly distributed; bright conditions in the room change according to outside conditions, so that the rhythm of light outside the building can be felt from inside the building; no glare.

Air health conditions in the room also play an important role to support the activities of its inhabitants. There are several things related to pollutants in space [17], first of all pollutants enter the room through various means both through cleaning materials and equipment, office equipment (photocopying, and printers) and also through finishing materials (painting). The best approach to reduce the amount of pollutants is to be careful in determining the specifications of equipment and materials and drain enough clean air to remove pollutants.

In connection with the policy on green buildings, this research tries to map various regulations that have been established so far by the Government of the Republic of Indonesia. This study identifies regulations that are directly or indirectly related to the implementation of green buildings in Indonesia. The identification process is based on the understanding that regulations on green buildings should consider the principles of green buildings (energy-friendly, environmentally friendly and human-friendly) throughout the building's life cycle process. Buildings can be considered less green if the process of mining the material, the process of producing the material, the process of transporting the material, the building process, the operational process, the maintenance process and the demolition process are not environmentally friendly, human-friendly and energy-friendly. Thus the identification of regulations is also carried out in various ministries such as the ministries of mining and energy, the ministries of industry, the ministries of trade, the ministries of transportation, the ministries of public works, and the national planning agency. Identification is also carried out at various levels of regulation ranging from acts, presidential regulations, ministerial regulations, regional regulations, governor regulations, and regulations of the mayor or regent.

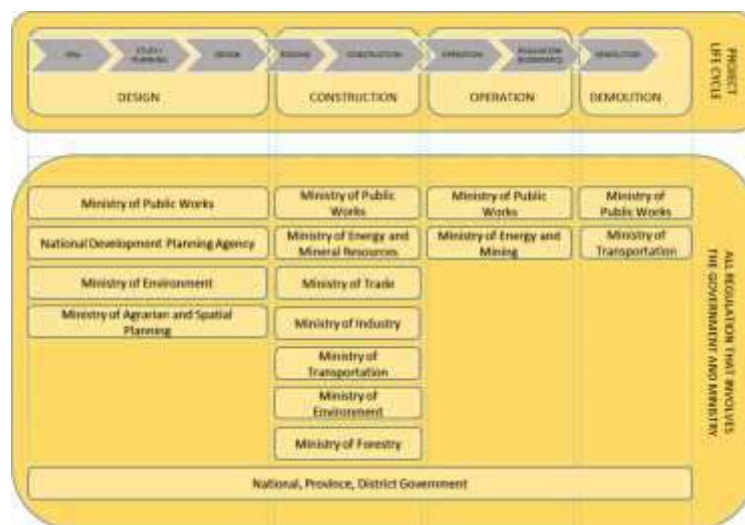


Figure 3. Regulation Identification

The results of the analysis show that the regulations currently available still do not fully accommodate the green building principles and the various regulations that are not synchronized. This condition implies directly on optimization of green building performance. When a stake holder requires 'green material', then the material is not necessarily available on the market. Products available in the market may come from illegal mining, or be processed by methods that are not environmentally friendly, or shipped from places far enough so that the value of embedded energy is high, or sent using transportation that is not environmentally friendly. Green building regulations downstream need to be supported by various regulations upstream so that green building products have high performance in their true contexts.

Principally, the government tries to place itself in the midst of various interests. The government is trying to ensure all the parties involved in the construction industry to carry out their obligations and at the same time get their rights. However, in certain parts it is normal that the government behaves in favor of certain interests for the sake of greater interests in the future, one of which is the alignments of the government to the environment. The desire to accommodate various interests in the community is often an obstacle in delaying the establishment or making the contents of the regulation very general because it must accommodate those who could not be able to implement it. As for those who are able, these conditions are used to apply the rules according to the requirements even though they are able to do better.

Problems with implementing and enforcing regulations also remain an obstacle. Regulations that have been set are usually through a process of re-socialization for a year before being fully implemented. The socialization process for a year is sometimes still considered inadequate, so implementation in the second year is still constrained. Another obstacle is the lack of readiness of the government in implementation due to lack of staff involved or incomprehensible understanding of regulations or incomplete technical guidelines for implementation or trade-offs involved in enforcing regulations.

The main consideration of developers when designing and building buildings is profit. Efforts to bring the issue of green building to the property business tend to be used as marketing objects for the more basic interests of profit. However, the developer will only adopt the concept of a green building if the application of the concept will not make the building to be built more expensive and / or unsold for sale. Developers tend to choose which parts of the green concept that can be adopted that are in line with their main interest, which is making a profit. As long as the application of this concept will have a good impact on the addition of profits (relative to the investment), the developer will be happy to implement it. However, if the application of this concept will only add to the expensive investment or operational costs without the possibility to get additional benefits or get benefits that are not commensurate with the business, then do not expect developers to apply them.

As the owner or manager of the funds, the developer has a large enough force to be able to determine the shape of the resulting building. The philosophical or technical considerations put forward by planning consultants in designing buildings are often broken with practical consideration of financial and developing trends. Financial interest (clappers) is the main consideration in determining the design of buildings to be built.

The obstacle often faced by architect is to convince their clients in this case the developer or building owner that the design has been optimal considering the interests of the environment, users and developers. Architects are often confronted by developers' comments about construction costs as a consequence of optimizing these three interests, including the application of a green building strategy in an effort to adopt environmental interests. The successful implementation of a green building is very dependent on the ability of the architect to convince the developer that the choice of a strategy is the result of optimizing the design and has considered various interests including the interests of the developer

Architects or Designers need a various energy and lighting simulation software to be able to design buildings with better environmental performance. However, not all architect specialize in having a special division or special staff to handle it. Some architect will only use the software when needed, one of which is to get green building certification. These conditions indicate that the existence of these softwares for the time being is only used to be used as a justification for designs that have been made before and not to be used in selecting various building design options.

The contractor feels comfortable in a position to carry out what has been planned by the architect and developer. The contractor's responsibility is limited to the design and implementation of the construction process, which refers to the design produced by the designer as efficiently as possible to obtain financial benefits. In some conditions, the contractor also carries out a kind of a re-design process (value engineering) aimed at minimizing costs without reducing the quality of the final output. Generally the contractor will propose changes in certain materials with consideration of ease of

purchase or ease of installation without changing the principle of design that has been made by the designer.

In the past decade, several contractors have begun to introduce the application of the green concept in the building process as part of the green building concept. The principle of green construction emphasizes more on efforts to reduce energy use and reduce the environmental impact on the construction process. Regarding the green strategy, the contractor generally puts itself in place to propose changes to the building envelope material even though the proposed changes are based more on efficiency and effectiveness of the construction process and not on environmental or user considerations.

4. Conclusion

Misunderstanding the principle of green building by the government as the regulator makes green building regulations have not been fully implemented properly. Efforts are still needed to adjust the contents of regulations and synchronize various regulations upstream to support the regulation of downstream green buildings. Other green building stake holders, namely The Designers, Contractors and Developers also do not seem to fully understand the principles of green buildings, so that the motivation to implement green buildings is only limited to comply the regulations and not to achieve the maximum green building performance.

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