The gaps of passive strategy option in Indonesia’s green building regulation

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Abstract. Implementing building regulations that could encourage stakeholders to apply the green building concept is one of the effort that could be done to realize a green city. Implementation of green building passive strategies, through the elaboration of building design that fit to the condition of the surrounding environment, are believed to be a solution to achieve optimal green building performance. Currently, the government has set a regulation as representation of green building policy (at least three green building regulations, namely Green Building Decree of Ministry of Public Works and Public Housing Regulation, Governor DKI Regulation of Green Building and Bandung’s Major Regulation of Green Building) and experts have also set up a rating system to support the green building policy. This study aims to determine the accommodation of passive strategies in regulations, as a policy representation of green building, by matching the availability of strategic options on those three regulations. It seems that efforts are still needed to complement and affirm the need for the application of the passive strategy of green buildings in order to obtain maximum benefits from the implementation of the concept of green building.

1. Introduction

Building as one of the city components plays an important role in realizing the vision of a city. Green city can be realized if the building inside also has the same vision and spirit, namely green buildings. To expand the implementation and to align views on the realization of green buildings, some cities set policies in the form of regulations. The regulation manages the role of stakeholders related to buildings and mentions the criteria that need to be fulfilled by stakeholders so that the building can be called a green building.

Principally, green building can accommodate two types of strategies, namely passive and active strategies. Active strategy is generally understood as a strategy to obtain the expected environmental conditions (especially thermal and visual conditions) by relying on the use of efficient electrical and mechanical equipment, while passive strategies are understood as a strategy to realize expected environmental conditions by relying on the design of buildings to make use of it at once anticipate environmental conditions. Although a building with certain conditions can only rely on passive strategies, but related to human dependence on electronic equipment, lighting requirements and air conditioning for 24 hours, the use of active strategies in certain conditions and time frames is inevitable.

Yeang [1] said that by considering the need for environmental conditioning to support human activities, these two strategies can be conditioned to work together on a building even though it is recommended to optimally utilize passive strategies before active work strategies. Attempts to rely
entirely on passive strategies are impossible to implement if humans expect a permanent condition of
the inner environment at all times because of outdoor conditions that change over time. On the other
hand, the efficiency of mechanical and electrical equipment that is getting better cannot be used as an
excuse to ignore the application of passive strategies or take advantage of passive strategies only to
fulfill the formalities of compliance with regulations for example. Efforts to prioritize passive strategies
as optimal as possible before the active strategy works should be a priority in implementing green
buildings.

2. Methodology
To find out the availability green building policies to accommodate the green building’s passive strategy,
the researchers conducted a literature study to trace the opinions of some experts on passive strategies
through books, journals, and proceedings. Furthermore, an analysis of the green building policies (which
are represented by available green building regulations) is carried out by comparing the various options
of passive strategies obtained in the literature with the passive strategies contained in the regulations. In
this paper, the researcher limits comparative studies only on three green building regulations, namely
the Governor DKI Regulation of Green Building No. 38 of 2012 concerning Green Building and
Ministry of Public Works and Public Housing Regulation No.02 / PRT / M / 2015 concerning Green
Building and Bandung’s Major Regulation of Green Building No.1023 of 2016 concerning Green
Building.

3. Results and discussion
According to Sharma [2], the use of passive systems could be done through understanding climate
climates and zones, identifying comfort zones, identifying heat sources, optimizing microclimatic
conditions, and defining characteristics needed for building configurations and building envelopes.
Complementing this, King [3] mentions several things that need to be considered when designing
buildings in humid tropical climates such as laying buildings, building forms, natural air conditioning,
building interior layout, rain, openings and imagery, and thermal mass. Furthermore, Sharma [2] states
that one of the important things in passive systems is passive cooling. The strategy that can be done to
achieve the optimal passive cooling system is the right window placement and natural lighting design,
the selection of the right glass material for windows and skylights, proper imaging of the glass when
heat is not desired, the use of light-colored materials for building envelopes and roofing, proper building
and orientation, and good landscape design. In addition, it can also be done by installing windows that
can be operated (open-closed), using landscape elements to direct the wind, placing windows with the
following window size for cross ventilation purposes, reducing internal obstacles (e.g. walls) so that
wind can still flow, using wing walls when crossing is not possible, and using stack ventilation to obtain
a chimney effect.

Sarte [4] added that the use of passive strategy can improve the performance of buildings in the
energy field. Passive strategies can be done through: building form and orientation processing, landscape
arrangement, choosing the right building envelope, designing natural ventilation, selecting building
materials, using low-emittance glass, installing radiation barriers, using bright/reflective colors.
According to Jones [5], buildings that considering their microclimate conditions through orientation
processing, building shapes and sheaths can save energy use in the amount of five to six times
conventional buildings during their life cycle periods.

Various passive strategy options for climate transfer according to the climate are outlined in a scheme
created by The Low Energy Architecture Research Unit (LEARN) of the London Metropolitan
University [6]. They divided the passive strategy options into three climatic conditions, namely hot
humid, hot arid and cold. The difference is that in hot climates, both humid and dry, the strategy used is
resist gain (heating avoidance) and promoting loss (building cooling). In cold climates the strategy used
is to promote gain (fastening heat gain) and resist loss (resisting heat release). The four strategies can
be done in four ways, namely conduction, convection, radiation and evaporation. Conduction method
can be done for resist loss and resist gain by minimizing heat flow (minimize conductive heat flow),
while to promote loss can be done by earth cooling. Convection can be done in hot and cold climates with minimizing infiltration for resist lost or resist gain.

Table 1 shows various passive strategy options that can be applied to buildings, both low, medium and high-rise buildings. The strategy includes a strategy for buildings to optimize building design (arrangement of orientation, shape, sheath, material and interior) before utilizing electrical and mechanical equipment. In addition, the building also needs to optimize all the potential that exists in the surrounding environment in order to create an environment that is comfortable for the occupants and economical in the utilization of energy and not to damage the environment.

| No | Definition of Passive Strategy | Strategy | Keywords | References |
|----|--------------------------------|----------|----------|------------|
| 1  | Architectural Design (The absence of electrical or mechanical equipment) | Determine orientation and elaborate the shape of the building | • Natural lighting | [1] |
|    |                                | Designing the building envelope and selects the materials | • Natural ventilation | [2] |
|    |                                | Layout design and selects the material (orientation, shape, envelope, interior) | • Shadow | [3] |
|    |                                | Optimizing building design | • Heating avoidance | [4] |
|    |                                | Utilize the surrounding landscape | • Building Cooling | [5] |
| 2  | Utilize the potential environmental conditions around the building | Utilize the surrounding buildings | | |
|    |                                | Utilize the local micro and macro climate | | |

The various options available in Table 1 are then compared with three green building regulations, namely Governor Regulation (Pergub) of DKI Jakarta No. 38 year of 2012 concerning Green Building and Ministry of Public Works and Public Housing Regulation No. 02 / PRT / M / 2015 concerning Green Building and Mayor Regulation (Perwal) of Bandung No.1023 year of 2016 concerning Green Building. The three regulations were chosen because they also represent three levels of government, namely the central government (Permen), the province (Pergub) and the city (Perwal) while representing various diversity of environmental conditions that need to be considered by the government in setting regulations.

Governor DKI Regulation No. 38 year of 2012 concerning Green Building divides the criteria of green buildings into two main categories, namely the new building category and the existing building category. This study will only limit the analysis of the criteria for green buildings for new buildings with the consideration that new buildings provide more opportunities for the adoption of passive strategies than existing buildings. The Governor DKI Regulation only applies to buildings with certain functions and certain areas (minimum 10,000 sqm).

The criteria listed on the Governor DKI Regulation for new buildings include energy efficiency criteria (building envelope systems, ventilation systems, air conditioning systems, lighting systems, in-building transportation systems, and electrical systems), water efficiency criteria (design of water-saving sanitary equipment and design of water use), indoor air quality criteria (content of fresh air, harmful gases and dangerous refrigerants), criteria for land management and waste (spatial requirements, supporting facilities, solid and liquid waste management), criteria for implementing construction activities (safety, health work and environment, water conservation during construction activities, management of waste from construction activities).

The contents of regulation related to the implementation of passive strategies for the thermal and visual environment are listed in the energy efficiency criteria for building envelope systems by specifying a 45 watt/sqm Overall Thermal Transfer Value (OTTV) limitation without giving details of
what strategies can be done to obtain the value; energy efficiency criteria for natural gas systems with limits as long as it is possible to reduce the cooling load with reference to SNI 03-6572; energy criteria for air conditioning systems with a room temperature limit of 25°C and relative humidity of 60% ± 10%; energy criteria for natural lighting systems with restrictions being an integral part of the building lighting system according to SNI 03-2396; Indoor air quality criteria take into account the indoor rate of air change and fresh air input; criteria for land and waste management for reforestation by mentioning the limits of a certain minimum area of the ground floor area for buildings with a certain number of floors and possible to be carried out on the roofs and walls of buildings and inside and outside buildings (the regulation recommend to use tropical, local vegetation and consume less water); criteria for land management and waste for pavement using permeable material. The seven passive strategy criteria are summarized in Table 2 below:

| Criteria Category       | Passive Strategy | Parameter                                           |
|-------------------------|------------------|-----------------------------------------------------|
| Energy                  | Building envelope| OTTV ≤ 45 watt/sqm                                   |
|                         | Natural Ventilation| Used as long as it is possible to reduce the cooling load |
|                         | Comfortable standard: Temperature 25°C                |
|                         | Humidity 60%±10%                                      |
|                         | Daylighting | Become an integral part of the building lighting system |
|                         | The indoor rate of air change and fresh air input    |
| Indoor Air Quality      | Greenery | Inside and outside the building                      |
|                         | Green roof, green wall                               |
|                         | Tropical vegetation, local, minimal water consumption|
| Land and Waste          | Pavement | Permeable material                                   |

In the Ministry of Public Works and Public Housing Regulation No.02 / PRT / M / 2015 concerning Green Building, the buildings affected by the requirements of this regulation include new buildings and existing buildings. Buildings that are subject to the requirements of building green buildings are divided into three categories, namely the mandatory category, recommended, and voluntary. This study will only limit the analysis of the mandatory green building criteria at the technical planning stage, namely site management criteria including building orientation, site processing including accessibility/circulation, management of B3 waste contaminated land, private green open space (RTH), pedestrian lane provision, management of building sites, provision of parking lots, outdoor lighting systems, construction of buildings on and/or under the ground, water and/or infrastructure/public facilities; the efficiency criteria for energy use include building envelopes, ventilation systems, air conditioning systems, lighting systems, in-building transportation systems, and electrical systems; the criteria for water use efficiency include water sources, water use, use of water fixtures; indoor air quality criteria include prohibiting smoking, controlling carbon dioxide and carbon monoxide, and controlling the use of refrigerant; the criteria for using environmentally friendly materials include controlling the use of hazardous materials, and the use of certified environmentally friendly materials (eco labeling); the waste management criteria include the application of the 3R principle (reduce, reuse, recycle), the application of a waste handling system, and the implementation of a waste generation record system; criteria for wastewater management include the provision of facilities for managing solid waste and liquid waste before being discharged into municipal sewers, recycling water from gray water, implementing the Occupational Health and Safety Management System, and implementing environmentally friendly behavior; green supply chain criteria include the use of construction materials, selection of suppliers and/or sub-contractors, and energy conservation.

The contents of regulation related to the implementation of passive strategies for thermal and visual environments are listed in: site criteria for the orientation and shape of buildings with limits to
maximizing natural lighting and minimizing heat propagation and according to site context; site criteria for site greening with restrictions according to local regulations; energy criteria for enveloping buildings with RTTV and OTTV limits of at least 35 watts/sqm; energy criteria for ventilation systems with limits to minimizing cooling loads; Energy criteria for natural lighting systems with maximum use limits. The five passive strategy options are summarized in Table 3 below:

Table 3. Identification of passive criteria and strategies in Ministry of Public Works and Public Housing Regulation (Permen)

| Stage | Criteria Category | Passive Strategy                  | Parameter                     |
|-------|------------------|----------------------------------|-------------------------------|
| Planning | Site Orientation and shape of the building | Maximize natural lighting and minimize building heating and considering the site context |
|       | Greenery         | Refer to local regulations       |                               |
| Energy | Building envelope | RTTV and OTTV min 35 watt/sqm    |                               |
|       | Ventilation system | Minimize cooling loads           |                               |
|       | Daylighting      | Make the most of it              |                               |

In Bandung’s Major Regulation No.1023 year of 2016 concerning Green Building, the building affected by the requirements of the regulations covers all new buildings and/or additions which are divided into 2 categories, namely buildings with an area of less than 5,000 sqm or a minimum of 5,000 sqm so that all buildings located in the administrative area of the city of Bandung have to comply with these regulations, including residential houses. This regulation also listed an additional criteria to accommodate the wishes of building owners who try to exceed the minimum criteria so that the building in question has the right to receive two and three star awards along with incentives in the form of adding floor layers or reducing land and building taxes. This study will only limit the analysis of the criteria for buildings with a minimum area of 5,000 sqm, namely: energy efficiency criteria including building envelope systems, air conditioning systems, lighting systems, in-building transportation systems, and electrical systems; water efficiency criteria include water source planning, water use planning, water saving sanitary equipment planning; and planning for handling wastewater; criteria for building management systems (SPB) include lighting systems, air conditioning systems, and in-building transportation systems; the criteria for managing air quality in mechanical ventilation spaces and systems include controlling carbon dioxide (CO₂) in certain rooms, controlling carbon monoxide (CO) in closed parking areas, and using air conditioning refrigerants; the criteria for land management include the provision of open green space, the provision of supporting facilities, and the management of solid waste and garbage.

The contents of regulation related to the implementation of passive strategies for thermal and visual environments are contained in: energy criteria for building envelope systems with RTTV and OTTV limitations of at least 45 watts/sqm; energy criteria for air conditioning systems with a room temperature limit of 25 °C ± 1 °C; energy criteria for natural lighting systems with limits to optimizing their use; air quality criteria in the space for ventilation systems with limitations if the use of natural ventilation is not possible; land management criteria for green open space (RTH) and green building area (DHB) with the limitation of the provision of green open space refer to permits and DHB (green roof and vertical garden) not to exceed 25% of green open space. These five passive strategy option are summarized in Table 4 below:

Table 4. Identification of passive criteria and strategies in the BGH Head of Bandung city

| Category Criteria | Passive Strategy | Parameter                     |
|-------------------|------------------|-------------------------------|
| Energy            | Building Envelope System | RTTV and OTTV min 45 watt/sqm |
|                   | Air Conditioning System | Room temperature limit 25°C ± 1°C |
|                   | Lighting System   | Optimize natural lighting     |
| Indoor Air Quality | Ventilation      | Mechanical ventilation is used if natural ventilation is not possible |
When we compared between the literature study and the three available green building regulations, not all passive strategy options have been explicitly stated in the green building regulations:

1. The strategy of orientation and shape of buildings is only mentioned in the Ministry of Public Works and Public Housing Regulation with the aim of maximizing natural expediency and minimizing heat.
2. The building envelope strategy is mentioned explicitly in all three regulations including the expected achievement number parameters. However, the regulation does not specify how to do it to get the desired value.
3. The interior strategy is not mentioned in the Governor DKI Regulation of Green Building, but it is mentioned in the Ministry of Public Works and Public Housing Regulation, although it is not specifically mentioned what strategies can be done along with the parameters.
4. Greening strategies are mentioned in all three regulations and have included various variations not only on the building site but also on the roof (green roof) and on the wall (vertical garden) or balcony (terrace garden). The Governor DKI Regulation even encourages the use of pavement which allows the absorption of water into the soil.

The five comparison points are summarized in Table 5 below:

| Passive Strategy | Parameter |
|------------------|-----------|
| RTH and DHB      | RTH according to rules |
|                  | DHB does not exceed 25% RTH |

4. Conclusion
Based on the results of passive strategy identification in Governor DKI Regulation of Green Building, Ministry of Public Works and Public Housing Regulation, and Bandung’s Major Regulation, it can be concluded that:

- Passive strategies are still hidden behind OTTV parameters as part of the energy criteria for building envelope systems. The hidden position should be clarified because:
  a. The application of passive strategies is precisely the main thing that must be explicitly written to emphasize the importance of enforcement efforts. However, the achievement of the value of OTTV and or RTTV can still be included as a parameter of achieving requirements.
  b. If OTTV is used as a parameter, what happens then is an effort to meet the minimum requirements. Even though what is expected is an effort to optimize the application of passive strategies so that the results can be more than just meeting the minimum requirements.

- The passive strategy option has not been fully described as one of the main strategies in implementing the green building concept. Impressed that passive strategies are only attempts to get natural lighting and natural ventilation. This impression is obtained because explicitly written information and natural energy are part of the criteria for green buildings but other strategies are not conveyed, for example the strategy of building envelope material selection, interior spatial planning strategies, strategies to optimize building design through processing building orientation, shape and envelope. The lack of explicit passive strategies should be clarified because:
a. Giving the impression of ignoring various passive strategy options in addition to natural lighting and ventilation
b. Giving the impression of weak government efforts to encourage the optimization of passive strategies implementation even though it was less encouraging for designers (architects) and various parties involved to optimize its application.

- Passive strategies are more often placed on the criteria of energy and indoor air quality because of their relevance to natural lighting and ventilation even though the application of passive strategies is also part of the criteria for reducing environmental impacts, criteria for the construction phase and criteria for building utilization.

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