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Graduation Topic : Integrated Façade System in High Rise Office Building in Tropical Climate Condition  
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## REFLECTION

The main aim of reflection in this section is to show the whole process of the graduation phase which includes the planning, process, and product of the design, so therefore it can be explained if the approaches that are applied on the process worked and background reasons behind it.

### 1. Planning phase

The planning phase started with the initial problem statement that came across which then chosen to be the topic of the graduation project. Firstly, it starts with the chosen location as the site for the project, which is in Jakarta, Indonesia. It is known that in Jakarta as a developing city, the most common issue at the moment is that the needs of having corporate look as the building façade in most of every office building in Jakarta, becomes more important than the awareness of the huge amount of energy that is required in order to create indoor thermal comfort inside the building. It is because the common corporate façade look, which most of the time is a fully glazed type, is not suitable for hot and humid climate as in Jakarta which then leads to high energy consumption for cooling load. While, the vernacular architecture in Jakarta was succeed to adapt with the climate condition.

Therefore it comes to the objective of the graduation project which mainly is to understand the hot and humid climate condition characteristic and how to adapt to it and find different possible solutions both from active and passive building strategies which can be integrated in the façade system in order to reduce the energy consumption for cooling load. Although it has been understood since the beginning of the planning phase that there are some limitations, such as there is no possibilities to have site visit, physical measurement, and prototyping test within the range of the graduation project.

Based on above explanation then the research question can be derived as *“to what extent an integrated façade system is able to reduce cooling load in high rise office building in hot and humid tropical climate condition?”*, which therefore the question should be able to be answered through three different aspects which are climate condition aspect, façade component aspect, and building strategies aspect. In order to be able to do it through three different aspects, combination between two different fields is done. The two fields are climate fields which is more focus on the building physics and energy performance calculation, and façade fields which is more focus on the technical and design implementation. The parameters for the design and technical result was influenced by the energy performance calculation and vice versa.

## 2. Process phase

Within the process, three aspects which are climate condition, façade component, and building strategies, have been researched in parallel in order to get early conclusion before the design phase starts. Therefore the schema of the thesis itself is divided into three part, which are research part, design development part, and conclusion part. Although in the real situation along the graduation project, the research part continued until the end of the design development part. The process to link between two different fields which are climate and façade leads to some challenges along the way since each fields influences each other.

In the beginning of the design process, in order to know and understand what are the possible building strategies that are able to reduce the cooling load in hot and humid climate, a lot of literature researches have been done. However, within the time limit that is given for the graduation project, it is impossible to do research on all the possible building strategies, therefore few parameters needs to be set in order to select the most potential building strategies and narrow down the scope of the research. The research process then resulted as the theoretical background to be able to go on further on the conceptual design.

Before started the conceptual design, each building strategies that have been found in the research parts are compared within specific parameters, which then be selected to be developed in the conceptual design. In the conceptual design phase, three selected building strategies which have the most potential to reduce the cooling load, were then studied further and the conceptual integration design were done. In the conceptual design part, physical experiments on one of the element of the building strategies, desiccant material, were done in order to understand physically the principle of how the system works and what benefits or drawbacks out of it. Moreover, several building simulations were also done in this stage to test the possible design to be developed further. The result of the conceptual phase was then evaluated and further development was done in the design development phase. Then in this phase, more accurate calculation on the dimension and performance on each building strategies were involved. Hence, after more accurate calculation was involved in the design development phase and insufficient data on one of the system of desiccant dehumidification system that has been chosen in the conceptual phase was found, the type of the system in the conceptual phase needs to be changed in order to have more feasible system.

Few changes on the design development phase were done as the result from the calculation and technical issues. Along the process of the design, one phase considered to be added after the design development phase, which shows the finalized design. In this phase, some assumption on minor aspects which considered not to have much influences in the energy calculation were made. This process shows that two different fields which involved in this project, influence each other and leads to a major design change.

## 3. Product and result phase

With the start of problem statement and research question in the beginning of the planning stage, followed by design process which includes conceptual design, design development and the finalized design, the answer to the main research question can be answered by the end product of the design. The finalized design shows the most potential design based on both technical and energy performance implementation,

which also answered the sub questions of the graduation project. Although several assumptions need to be made and several systems need to be changed along the design process, the end product of the integrated façade system is able to reduce the cooling load by 40% and uses 1/3 of the energy in comparison to normal air conditioning system. The results were carried out by the building simulation and hand calculation on the finalized design.

Further research on new system which is applied in the final product and physical prototyping test should be carried out in order get more valid result, since in this project, there are some limitations on the existing data for liquid desiccant dehumidification system in integration with indirect evaporative cooling. Furthermore, no physical test was done to prove that the system will 100% worked. Limitation on complex inputs to create the same system for dehumidification and indirect evaporative in the building simulation tool were also occurred in the design development phase.

However, this project shows different possible building strategies as solution in order to reduce the cooling load in hot and humid climate and shows its the potential and drawbacks which able to be integrated in the façade system and applied in high rise office building in Jakarta. By showing the different possibilities of building strategies and its integration, the result of the energy performance of the integrated facade, and the amount of reduction on the cooling load, different perspectives on having integrated façade system instead of common international or corporate look for high rise office building in developing city as Jakarta can be applied and developed further.