

In our daily life, we usually see various buildings in different shape and materials. Do you know the reason? It is because one of the considerations is to improve the energy efficiency and it can be proved by mathematics.

The first factor is the shape of building. The energy efficiency measurement can be calculated by Surface Area to Volume Ratio. A building with a small surface area compared to its volume will be more energy efficient. Three types of buildings, quadrangular pyramid, cuboid and cylinder, are used to compare energy-efficiency performance and those buildings are commonly found as examples. From the calculation result, the building in quadrangular pyramid shape reveal the best energy-efficient performance.

The second factor is the material use. The energy efficiency of the material can be measured by U-value. It is used to measure how well or how badly a component transmits heat from the inside to the outside. The slower or more difficult it is for heat to transfer through the component, the lower the U-value. This means that we are looking for a lower U-value. A bar chart of U-values of different materials is found. From the chart, we can see that timber is the best for energy efficiency. In conclusion, building with quadrangular shape and made with timber is the most energy efficient.

However, in real life, the architect also needs to consider the applicability, safety and economic reason while designing the building. Therefore, it is rare to see buildings made with the best shape and material. Without a doubt, mathematics is extremely important for architecture. If Mathematics didn't exist, people would have problems to improve building's energy efficiency!